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Recreation and the Aging Process

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Abstract

In this study, approximately 3,000 men responded to a questionnaire covering 67 recreation activities. These men indicated whether they liked, disliked, or felt indifferent toward each activity; their frequency of participation in each; and their reasons for not participating more frequently if they desired more frequent participation. From the 3,000 questionnaires, 411 usable questionnaires were secured. The respondents were grouped into age groups as follows: 20-29, 30-39, 40-49, and 50-59 years. The recreation habits and desires of each of the age groups and reasons for discrepancies bewteen their recreation habits and desires was reported. Trends in habits, desires, and reasons for failing to meet recreation desires were also reported.

IN RECENT YEARS there has been increasing concern over the growing numbers of older people and the social and economic problems which they present. Edward J. Stieglitz points out, through predictions possible from the census, that even though our country now has a serious economic problem in supporting its incapacitated old people, the problem will grow tremendously in the next 40 years.

Studies of the 1940 census reveal that while the population of the United States as a whole increased 7.21 per cent over 1930, the number of persons aged 65 or more increased 35 per cent. In 1940 there were approximately 9 million people 65 or more years old in this country. Theodore Klump, conference chairman of the National Committee on the Aging of the National Social Welfare Assembly, predicted that in less than 30 years there will be approximately 24 million people in this age group in the United States.

While the number of people over 65 will have increased 100 per cent, the rest of the population will show only a 20 per cent gain. These figures mean that the burden of support will fall upon a considerably smaller segment of the population unless society learns to sustain and to utilize the productive abilities of older people.

Statistics show that elderly people are not at all healthy, as a group. A man in his 40's or 50's disabled for years by arthritis or cerebral, peripheral, or coronary arteriosclerosis is a far greater social loss and a heavier burden upon his immediate family and society as a whole than a man who dies immediately. The cost of these chronic diseases of middle and old age must be measured by more than mortality tables.

An increasing number of professional people and groups are becoming interested in the personal, social, and economic problems associated with an aging population. Almost all the approaches to this problem have been from the standpoint of preparing the individual psychologically and economically

for his remaining years of usefulness. Social security measures provide the individual with a minimal standard of living. The social and psychological approaches emphasize the problems of readjustment. The medical approach emphasizes relieving pain and enabling a survival level of physical efficiency. Few studies have emphasized the establishment of health and recreational habits which would sustain an individual's mental and physical health status at a high level until a relatively advanced age.

The establishment of proper recreational habits promises a partial solution to the problem of sustaining mental and physical fitness at a high level. Several studies have shown that middle-aged men, just as younger men, can improve their physical fitness status as indicated by tests of muscular strength, power and endurance, agility, and cardiovascular and respiratory efficiency, through a program of progressive physical exercise.

A number of psychologists and psychiatrists, writing on the mental and psychological problems of older people, point out that the tensions, conflicts, and emotional strains which are concomitants of a complex civilization can and do cause a number of physical ailments such as hypertension, cardiac troubles, and ulcers. They emphasize the important part recreational activity plays in relieving these tensions and conflicts and in that way decreases the probability of suffering from these predominantly psychosomatic ailments.

However, people will not engage in active recreation activities simply because there is convincing evidence presented them that it will "do them good." There must be an attempt made to study ways to change their leisure-time habits. In most cases, the way in which people spend their leisure time is determined largely by habit. How a man spent his leisure time at age 30 is an important factor in determining how he spends it at age 40. Therefore, the recreational life of man must be viewed as a continuum. It would seem that the first step in making a study of the procedures whereby the recreational activities of men might be redirected would be to find what the recreational habits of adult men are at the present time.

The Problem

This study will attempt to take a step in the direction of finding ways and means of changing the leisure-time pursuits of adult men by discovering the recreational habits and interests of men at various age levels. The following are some of the objectives of the study:

(a) To determine how men at various age levels spend their leisure time.
(b) To determine in which activities men would like to participate.
(c) To determine the discrepancies between men's recreational practices and desires.
(d) To determine men's reasons for not participating more frequently in those activities in which they desire more frequent participation.
(e) To determine which activities are participated in most frequently by men in each of the four age groups (20-29, 30-39, 40-49, and 50-59).
(f) To determine which activities are liked by the greatest proportion of men in each of the four age groups.
(g) To determine the changes in recreational habits from decade to decade.

(h) To determine the changes in recreational interests from decade to decade.
(i) To determine which activities, if any, men find enjoyable at all ages.
(j) To determine the relative constancy in appeal of the various recreation activities from one age group to the next.
(k) To determine the above with respect to income.

Limitations

The bulk of the responses to the questionnaire were secured from one industrial plant in Cleveland, Ohio. This company did not sponsor a recreation program for employees. The results might have been different if the company had such a program.

It would have been desirable to include more responses from men of the upper and lower income groups (0-$1,999 and over $7,000). Statistically, the findings with respect to these two income groups can be regarded as only indicative.

Since this study is confined to men, the conclusions are not applicable to women.

When planning recreational programs for adult men, the recreational habits and interests of these men are only two factors which must be considered. Other factors would be facilities available, funds, competencies of the recreation leaders, and factual evidence regarding what is best for the men.

Methods of Procedure

The procedures utilized in this study were as follows:

(a) Synthesizing selected writings and studies in fields related to physical education and recreation (principally sociology, psychiatry, and geriatrics) and adapting the principles discovered to the fields of physical education and recreation to serve as guides for the conduct of recreation programs for middle-aged men.

(b) Discovering the recreational interests and habits of adult men between the ages of 20 and 60 by means of a questionnaire covering 67 recreation activities, administered to approximately 3,000 men residing in 6 cities of varying size (Cleveland, Ohio; Columbus, Ohio; Delaware, Ohio; Butler, Pennsylvania; New Castle, Pennsylvania; and Slippery Rock, Pennsylvania). These men were engaged in a variety of occupations and represented a wide income range.

(c) Talks with retired and middle-aged men concerning their leisure-time and recreational interests and problems.

(d) Correspondence with gerontologists and other professional people interested in the problems of aging.

The recreational questionnaire was the principal tool of this study. This questionnaire asked men to indicate their attitude toward participating in each of 67 recreational activities by placing a check mark in one of three columns headed Like, Dislike, and Indifferent. They were also asked to indicate their frequency of participation in each of these activities. They were

further asked to indicate the reason if they were prevented from participating as frequently as they would like. If the limiting factor was a health reason, they wrote "health"; "time" if it was lack of time; "money" if it was due to lack of funds; "facilities" if local facilities were lacking, inadequate, or too distant; or "knowledge and skill" if lack of knowledge and skill limited their participation.

The Cleveland Pneumatic Tool Company in Cleveland, Ohio, was kind enough to co-operate in this study. The bulk of the responses to the questionnaire was secured from this industry with the generous and untiring assistance of its labor relations supervisor, Ernest Molnar. All 2,000 employees, both office and factory and at all echelons, were polled. An additional 1,000 questionnaires were completed by residents and business people of Cleveland, Ohio; Columbus, Ohio; Delaware, Ohio; New Castle, Pennsylvania; Butler, Pennsylvania; and Slippery Rock, Pennsylvania. The faculties of Ohio Wesleyan University and Slippery Rock State Teachers College were polled. Members of the Golden Age Group of the Central Community House in Columbus, Ohio, were also interviewed.

From the above groups, 411 usable questionnaires were secured. Many of these working men did not fill out the form completely. They indicated their attitude toward the activity but did not indicate the frequency of their participation. Since the writer planned to relate frequency of participation to the percentage liking each activity, it was necessary to discard those questionnaires not filled out completely.

For tabulating purposes, the questionnaires were sorted into the following four age groups: 20-29 years, 30-39, 40-49, and 50-59. After all usable questionnaires had been tabulated for age groupings, they were re-sorted and tabulated according to the following six income groupings: 0-$1,999 annually $2,000-$2,999; $3,000-$3,999; $4,000-$4,999; $5,000-$6,999; and over $7,000.

Summary and Conclusions

As men grow older, they like fewer recreation activities, feel indifferent towards an increasing number, and dislike an increasing number.

(a) There are seven sedentary activities which are liked by an increasing number of men from each succeeding age group. These are:

1. Checkers
2. "Still" fishing
3. Card playing
4. Listening to the radio
5. Watching television
6. Reading
7. Stamp collecting

(b) It should be noted that the activities which show an increasing number of men liking them with increasing age are of a sedentary nature and are enjoyed either alone or with only a few people.

(c) There were six activities which showed an insignificant decline in interest with increasing age. These were:

1. Bowling
2. Bait casting
3. Motoring
4. Puttering and repairing
5. Visiting friends
6. Watching sports events

(d) The following is a ranking of the activities according to the over-all decrease in the percentage of men indicating liking for them. (It should be kept in mind that some of the activities show a high proportion of men from the 20-29 age group liking them while others show only a small proportion of men from the 20-29 age group liking them. This means that the former group can show a greater decrease over the total age span and yet be liked by a greater proportion of men in the 50-59 age group.) The listing follows:

1. Table tennis
2. Swimming
3. Touch football
4. Volleyball
5. Social dancing
6. Softball
7. Badminton
8. Dating
9. Ice Skating
10. Baseball
11. Basketball
12. Canoeing
13. Roller skating
14. Night clubbing
15. Golf
16. Horseback riding
17. Gymnastics
18. Skiing
19. Music
20. Boating
21. Social drinking
22. Weight lifting
23. Tennis
24. Movies
25. Metal craft
26. Photography
27. Ice hockey
28. Chess
29. Painting
30. Sailing
31. Handball
32. Archery
33. Wood carving
34. Calisthenics
35. Water polo
36. Hunting
37. Conversing
38. Bag punching
39. Walking
40. Horseshoes
41. Watching sports
42. Deck tennis
43. Bowling
44. Visiting friends
45. Bicycling
46. Tumbling
47. Wood working
48. Hiking
49. Fencing
50. Puttering and repairing
51. Square dancing
52. Speedball
53. Still fishing
54. Bait casting

NOTE: Tumbling, fencing, and speedball show little decline in liking principally because they start few men indicating like for them.

The three types of activities which show the greatest decline in liking are: (1) those which require quick reaction time (2) those which require physical stamina and endurance; (3) those which satisfy the romantic and erotic impulses.

The rank of activities according to the proportion of men liking them is approximately the same for all six income groups.

(a) Apparently men become more individualistic in their recreational likes and dislikes as their income increases since the percentage of men liking each activity ranking first, second, third, and down to 20th becomes smaller for each succeeding higher income grouping.

(b) Liking for a few activities seems to be related to income.

1. The percentage of men who enjoy conversing increases with each higher income grouping.
2. Enjoyment of card playing increases with income.
3. Activities which provide social contacts are liked most by men from higher income grouping, the over $7,000 income group.
4. Men of the $5,000-$6,999 income group like the sports types of recreation activities more than do men of any other income group.

With respect to frequency of participation, the majority of the 67 recreation activities maintained their rank from one age grouping to the succeeding grouping. Apparently, the recreational habits of younger men do not differ greatly in kind from those of older men.

(a) There were a few activities which showed a decline in frequency of participation with increasing age. These were:

1. Conversing
2. Social drinking
3. Night clubbing
4. Dating
5. Weightlifiting
6. Calisthenics

(b) Participation in recreational activities of a sports type is meager at all age levels.

1. Bowling, "still" fishing, and bait casting were the only sports listed among the first 20 activities for all four age groupings with respect to frequency of participation.

(c) As men grow older, they participate less frequently in almost all forms of recreational activity.

(d) The proportion of their leisure time which men spend on gardening, motoring, hiking, metal craft, bait casting, "still" fishing, and checkers increases slightly with age.

Men of all income groups participate very little in sports during their leisure time.

(a) Men of the $5,000-$6,999 income group participate in sports more frequently than men of any other income group.

(b) Men of the $2,000-$2,999 income group participate in sports less frequently than men of any other income group.

(c) Participation in sports increases in frequency from the $2,000-$2,999 income group with each higher income group until the $5,000-$6,999 income grouped is reached. However, men of the over-$7,000 income group participate in sports somewhat less than men of the $5,000-$6,999 income group. This is accounted for in part by the fact that men of the over-$7,000 income group are older men.

With respect to frequency of participation in all forms of recreational activity, men of the $5,000-$6,999 income group participate most frequently. Next in order of frequency of participation are the $4,000-$4,999; $3,000-$3,999; $0-$1,999; $2,000-$2,999; and the over-$7,000 income groups.

Men of all age and income groups do not satisfy their desire to participate in recreation activities of an active or sports nature as frequently as they do those of a mildly active or sedentary nature.

(a) Baseball, swimming, hunting, and movies showed a great discrepancy between the proportion of men liking the activity and the frequency of participation.

(b) The discrepancy score decreases more rapidly for the active forms of recreation than it does for the sedentary forms.

1. As men grow older they limit their recreational desires more and more and are increasingly successful in satisfying them.
2. Men's liking for the active forms of recreational activity decreases wth increasing age more rapidly than their liking for the mildly active or sedentary forms.

NOTE: The discrepancy score represents the difference between the percentage of men indicating liking for an activity and the average frequency of participation as indicated by the participation index.

For income groupings, as for age groupings, the discrepancy between the interest in an activity and the frequency of participation was greater for the active forms of recreation than it was for the sedentary forms.

(a) For the majority of activities, there was no consistent pattern in the discrepancy score from one income group to the succeeding groups.

The reason for unsatisfactory participation most frequently listed by men of all age groups was lack of time.

(a) The proportion of men who state poor health limits their participation increases with age.

(b) The proportion of men who state lack of money limits their participation increases until the age of 40-49 and then drops rather sharply after this age.

(c) The proportion of men who state lack of facilities limits their participation decreases with age.

(d) A greater proportion of men list reasons for unsatisfactory participation for the active forms of recreation than do for the sedentary forms.

(Submitted 5-5-54)

Relation of Personal Success in Intercollegiate Athletics to Certain Aspects of Personal Adjustment[1]

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Abstract

The investigation studied differences in personal adjustment between 59 athletes who won letters in varsity sports and 59 athletes who did not win letters; both groups had participated successfully in high school and college Freshman sports. The data were obtained from record research and interviews. Letter winners were taller and heavier at matriculation and had a history of less serious injuries. Letter winners participated in fewer college activities but expressed greater satisfaction with their college careers. No differences in scholastic achievement were found when aptitude was controlled. Letter winners sustained more injuries during their college careers than non-winners.

THE PLACE OF physical education in the total education process has been emphasized and de-emphasized in turn. At the present time, physical education is thought by many in that field to be as beneficial to personality development and adjustment as it is to physical development (1, 6). Some writers maintain that physical education makes a contribution to general adjustment and well-being that can be obtained from no other source (3, 8, 9). Other authors feel athletic programs are generally harmful and can result in personality difficulties because of the excessive publicity given organized athletics (2, 4, 7) or because of the fact that certain students are inevitably left out or do not achieve success in these activities (5).

The purpose of this investigation was to determine whether observable differences in certain aspects of social, health, and scholastic adjustment exist between a group of students who won varsity letters and a group who did not win varsity letters in intercollegiate athletics. Both groups had active athletic backgrounds through high school and the Freshman year at college. The study was thus concerned entirely with students with previously demonstrated athletic skill and interest. The central hypothesis of the research was that

[1]This study was made in partial fulfillment of the requirements for the doctoral degree, School of Education, Cornell University. Research was done in conjunction with the Student Stability Studies sponsored by the Department of Clinical and Preventive Medicine, Cornell University. The authors are grateful to Robert Kane, director of athletics at Cornell University, for his co-operation.

[2]Dr. Bentson is now with Personnel Division, Western Electric Co., New York, N. Y., and Dr. Summerskill is in the Department of Clinical and Preventive Medicine, Cornell University.

the group which went on to achieve success in varsity athletics would exhibit more satisfactory social, health, and scholastic adjustment, as measured, than the group failing to achieve distinguished success in varsity athletics.

Procedure

The initial sample included all male students who had won Freshman numerals in athletics at Cornell University in 1948 or 1949. From this sample of 253 athletes, all who had left the University temporarily or permanently before 1952 were excluded. Of the remainder, 59 were found to have achieved success in varsity athletics (i.e., in football, basketball, baseball, track, or crew). These were compared with 59 others chosen by random selection from the group of athletes who did not achieve varsity success. The data from records described below were obtained for all 118 subjects. The data from interviews were obtained from 17 letter winners who were available at the time of the study and an equal number of non-winners.

HEALTH DATA

The health adjustment section of the investigation was concerned primarily with injuries and with those physical complaints commonly considered to be associated with psychological or psychosomatic illness. Record research for this purpose was carried out by a staff member of the Student Medical Clinic at the University who reviewed: (1) the appropriate medical history forms filed by students at matriculation, and (2) the medical charts recording illnesses or accidents for each student.

SCHOLASTIC DATA

These data included cumulative grade-point averages through the first three years of college and the number of times the subjects were officially warned or placed on probation according to records of the Dean of Men and the University Registrar. Scholastic Aptitude Test scores were also obtained for 48 subjects in the letter-winning group and 47 subjects in the non-winner group. Ohio State Psychological Examination scores were available for 9 additional subjects in each group. The number of changes in major subject were also recorded for the 34 subjects interviewed.

SOCIAL ATTITUDES DATA

The social adjustment data were obtained by interviewing athletes of the 1949 Freshman class with the aid of an interview guide. The subjects were told that the purpose of the study was to learn what athletics meant to men who had participated in sports in high school and college and how they felt about their athletic participation.

The interview schedule, developed through trial interviews and conferences with other investigators, contained 84 questions and required approximately one hour to administer. The questions pertained chiefly to participation in extracurricular and fraternal activities in high school and college, attitudes toward extracurricular activities and fraternal organizations, relations with

fellow students, and estimates of benefits derived from college experiences. The schedule provided response categories for the interviewer to check during the process of the interview but the nature of these categories was not made known to the subjects. Replies were recorded verbatim or in summary for some questions. Throughout the interview, no comment was made which would pass judgment on the subject's attitudes. All subjects interviewed appeared to have a cooperative attitude toward the investigation.

Results

The findings of the study will be discussed in the following order: (1) background data, (2) health, (3) scholastic performance, and (4) social attitudes.

BACKGROUND DATA

The background of the two groups was similar in many respects, including occupation of parents and sibling order. However, there were near significant differences between the two groups in religious affiliation. The letter winners were predominantly Protestant and included only two members of the Hebrew faith. The non-winners included ten Hebrews and correspondingly fewer Protestants. The proportion of Roman Catholic students in each group was similar.

It was also found that letter winners had spent an average of 8.82 seasons in the various high school sports whereas non-winners had spent an average of 7.06 seasons. This difference is significant at the .06 level.

As Table 1 shows, there were significant differences between the two groups in height and weight at the time of college matriculation. When height and weight were analyzed by the type of Freshman sport participated in at the University, specific differences were found for subjects participating in football, baseball, and crew.

TABLE 1

Mean Difference Analyses of Weight and Height at College Matriculation

Analysis	Letter Winners			Non-Winners[1]			C.R.	P
	N	Mean	Sigma	N	Mean	Sigma		
Weight								
Baseball	8	169.00	18.06	13	150.38	15.43	2.42	<.05
Football	33	182.73	14.42	18	174.50	10.28	2.36	<.05
All Athletes	59	174.64	19.50	58	161.45	19.63	3.65	<.01
Height								
Crew	10	73.75	2.89	7	70.79	2.91	2.07	<.05
All Athletes	59	71.86	2.44	58	70.68	2.28	2.69	<.01

[1]Data concerning height and weight were not available for one subject in this group.

HEALTH

Chi square analysis of the medical history data revealed a tendency toward differences in the types of injuries sustained by the two groups *before entering*

the University. The letter winners had less often sustained an injury to a bone or joint but more often had injured muscles and knee cartilages. There was also a slight tendency for the letter winners to have received fewer injuries to the head, neck, or back. The letter winners more often reported swollen eyelids and ankles than the non-winners, but less often reported swollen glands. The medical history further revealed that the letter winners had been bothered significantly less by persistent or recurrent nasal drip or sneezing.

The records of medical care *after entering the University* revealed differences between the groups as indicated in Table 2. The letter winners had a higher number of admissions to the Infirmary than did non-winners, and were confined for longer periods of time. These data also revealed that the letter winners had sustained a higher mean number of injuries than had the non-winners. The two groups did not exhibit any differences in the frequency of illnesses thought to be important for their psychosomatic implications (i.e., gastrointestinal upsets, allergies, colds).

TABLE 2
Mean Difference Analyses of Medical Care

Analysis	Letter Winners			Non-Winners			C.R.	P
	N	Mean	Sigma	N	Mean	Sigma		
Admissions to infirmary	59	.80	.82	59	.46	.79	2.29	<.05
Days confined in infirmary	59	3.25	4.83	59	1.81	3.14	1.92	>.05
Injuries	59	2.36	1.91	59	1.61	1.50	2.36	<.05

SCHOLASTIC PERFORMANCE

Letter winners were enrolled more frequently in Engineering and less frequently in Arts and Science than non-winners. No significant differences were found in probationary status. The data regarding changes of major subject revealed that too few subjects had changed their major to allow any statistical analysis.

As indicated in Table 3, mean difference analysis of average grades revealed no difference in grades when all subjects in each group were considered. However, there was a tendency toward a difference in grades for those subjects with Scholastic Aptitude Test scores available. Mean difference analysis of the SAT scores for the two groups revealed significant differences, with the non-winners scoring higher on both SAT Math and Verbal tests (Table 3).

TABLE 3
Mean Difference Analyses of Grades and Scholastic Aptitude Test Scores

Analysis	Letter Winners			Non-Winners			C.R.	P
	N	Mean	Sigma	N	Mean	Sigma		
Grades (Entire Group)	59	76.96	3.88	59	77.66	4.76	.88	>.35
Grades (Men With SAT Scores)	48	76.69	3.76	47	78.21	5.02	1.67	>.05
SAT Verbal	48	489.72	80.88	47	543.72	90.33	3.25	<.01
SAT Math	48	569.25	104.68	47	611.53	90.46	2.11	<.05

When SAT scores were analyzed by schools within each group, no differences were indicated. Ohio State Psychological Examination scores were available for nearly all subjects who did not have SAT scores, and the mean Ohio State scores did not differ for the two groups.

Since the findings concerning grade-point averages and scholastic aptitude did not appear to be conclusive in their relationship up to this point, the data were subjected to single classification analysis of covariance. The resulting F value proved very small and non-significant. It may be concluded that letter-winners and non-winners do not differ in cumulative grade-point average at the end of six terms when the influence of verbal and mathematical scholastic aptitude is held constant.

SOCIAL ATTITUDES

The interview data did not reveal any significant differences between the two groups concerning their high school activities. However, near significant differences were found in relation to the number of extracurricular activities in high school and satisfaction with the amount of time devoted to high school athletics. The non-winners had participated in a greater number of extracurricular activities other than athletics, and were less well satisfied with the time they had devoted to athletic activities.

As might be anticipated, the groups differed in regard to participation in extracurricular activities at the University. The letter winners tended to devote less time to non-athletic activities than non-winners, and were inclined to participate in social activities and honorary organizations relating to athletics. The non-winners participated in more seasons of intramural sports, to a significant degree.

Interview data also revealed differences between the two groups in their satisfaction with the time spent in university athletic participation. While the letter winners felt their athletic participation had interfered with their course work, most of them said they would spend the same amount of time in athletics if they were repeating their college careers. Most non-winners would spend more time in sports if they could repeat their college careers (Table 4). The groups also differed in the degree of satisfaction they had experienced from university athletics as compared to high school sports.

TABLE 4

Amount of Time Subjects Would Devote to Athletics If Repeating College Careers

Amount of Time	Number of Letter Winners	Number of Non-Winners
Same time	14	4
More time	2	10
Less time	1	2
Uncertain	0	1
	$X^2 = 10.80$	df = 1[1] P <.01

[1]The "Less Time" and "Uncertain" categories were eliminated from the analysis to avoid small expected frequencies.

Letter winners were most satisfied with university sports while non-winners favored their high school athletic participation (Table 5).

TABLE 5
Relative Satisfaction with High School and University Athletics

Satisfaction	Number of Letter Winners	Number of Non-Winners
High school sports more satisfying	3	11
University sports more satisfying	11	6
Equally satisfying	3	0
	$X^2 = 5.81$	df = 1[1] $P < .02$

[1]The "Equally satisfying" category was eliminated from the analysis to avoid small expected frequencies.

As shown in Table 6, the interview data indicated that letter winners and non-winners differ in their attitudes concerning the relative acceptability of athletes and other men to peer groups. The letter winners felt athletes are more acceptable to university women than are other men, while the non-winners did not hold this opinion. Tendencies in the same direction were found concerning the acceptability of athletes to university men.

TABLE 6
Opinions Concerning the Reaction of University Women to Athletes and Other Men

Opinion of Reaction	Number of Letter Winners	Number of Non-Winners
More favorable to athletes	12	6
Same reaction	2	11
Less favorable to athletes	3	0
	$X^2 = 8.02$	df = 1[1] $P < .01$

[1]The "Less favorable" category was eliminated to avoid small expected frequencies.

Summary and Conclusions

This study was concerned with certain aspects of personal adjustment in a group of 118 athletes. Half this group won letters for participation in intercollegiate athletics at the varsity level and half did not. Conclusions are based on comparisons of record information for all subjects and interview data for representatives of the two groups.

1. *Success in intercollegiate athletics is related to certain characteristics of athletes which are present upon entering college.* Among these characteristics were weight and height which were positively related to successful participation in major sports at the varsity level. Intercollegiate athletes had also participated more extensively in high school sports and had experienced fewer injuries during that participation. More difficult to interpret is the finding of differences in religious preference between varsity letter winners and non-winners. Further research on this topic might be concerned with control variables such as discrimination by teammates or coaches, peer expectations, family pressures, financial needs, or academic achievement needs.

2. *Success in intercollegiate athletics does not have a generalized effect upon the adjustment of these students.* Effects of varsity participation appeared specific within the health, academic, and social adjustment areas. For this reason, the central hypothesis of the research cannot be summarily accepted or rejected.

3. *Success in intercollegiate athletics increases the risk of injury.* Letter winners spent more time in the University infirmary because of injuries. The incidence of common illnesses was found to be similar in both groups.

4. *Success in intercollegiate athletics per se is not related to academic performance.* Varsity athletes were admitted to the University with somewhat lower Scholastic Aptitude Test scores and subsequently obtained somewhat lower grades than non-varsity. The groups did not differ grades when influence of aptitude measured by test scores was controlled statistically.

5. *Success in intercollegiate athletics is related to attitudes about athletics and self.* The letter winners were found to be highly satisfied with intercollegiate athletics as such and were better satisfied with the amount of time devoted to this activity even though they stated that their participation in college extracurricular organizations was limited. Of some importance, the successful athletes clearly felt that esteem on the campus was greater because of athletic achievement. During the interviews, the letter winners expressed strong feelings of personal satisfaction resulting from their success in varsity sports. They also expressed deep satisfaction with the social interaction and feelings of team spirit they had experienced. The values which the athletes label "character development," "team spirit," "social development," and "ability to accept other people," which they feel were gained through their athletic participation, will likely continue to be of importance. Further research is necessary to determine the degree of permanency of these effects.

REFERENCES

1. A Special Report, Child Health and Recreation Extension Activities. *The Thirty-Seventh Annual Report of the Superintendent of Schools of the City of New York.* 1934-35, p. 81.
2. Blanchard, B. E., Behavior Frequency Rating Scale For the Measurement of Character and Personality In Physical Education Classroom Situations. *Research Quarterly, 7:* 56-76, 1936.
3. Brownell, C. L., and E. P. Hagman. *Physical Education—Foundations and Principles.* New York: McGraw-Hill, 1951, p. 22.
4. Cole, L. *Psychology of Adolescence.* New York: Farrar and Rinehart, Inc., 1936, p. 29.
5. Groves, E. R., and P. Blanchard. *Introduction to Mental Hygiene.* New York: Henry Holt and Co., 1930, p. 299.
6. Schneider, Elsa, ed. *Physical Education in Small Schools.* Washington, D. C.: National Education Association, 1948, pp. 9-14.
7. Slavson, S. R. *Creative Group Education.* New York: Association Press, 1938, p. 168.
8. Watson, Goodwin, Personality Growth Through Athletics. *Research Quarterly* **9:** 408-10, 1938.
9. Witty, P. A., and C. E. Skinner, et al. *Mental Hygiene in Modern Education.* New York: Farrar and Rinehart, Inc., 1939, p. 512.

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Evaluation of a Basic Skills Curriculum for Women Students of Low Motor Ability at the University of Washington[1]

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Abstract

This study deals with the value of a general basic skills curriculum for Freshman women of low motor ability. A group of these students received instruction in the special curriculum previous to entering the regular service program. Follow-up procedures included testing of motor ability after the special instruction, attitude toward physical education throughout the physical education experience, and skill and knowledge achieved at the end of a beginning course in badminton, bowling, or folk dancing. When this group is compared to a matched group, results indicate that the instruction was effective in improving general motor ability and attitude toward physical education, and in gaining skill and knowledge in specific activities.

THE PURPOSE OF this study is to determine whether instruction in a special basic skills course for low motor ability college Freshman women previous to instruction in the regular physical education activity program:

1. will help these students experience more success in their subsequent physical education courses
2. will lead to better general motor ability and to an improved attitude toward physical education.

Procedure

The curriculum for the basic physical education course[2] was established after study of the literature, observation and testing of students found to have unusual difficulty in learning physical education skills, and two preliminary trial courses of instruction.

Study of the low motor ability students through the literature, observation, and interviews with them, revealed that as a group they lack interest in physical activities. This seems to be due, at least in part, to lack of experience in activity, poor instruction and unsatisfactory physical education experiences leading to repeated failure and thus to feelings of inferiority in any motor situation which they encounter. They lack the knowledge of the way to use the body efficiently as well as the skill to perform effectively.

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[1]Summary of a study done in partial fulfillment of the requirements for the Doctor of Philosophy degree at New York University, 1954.

[2]See Appendix, page 26.

Instruction in the basic physical education class, therefore, attempts to give the students a better understanding of efficient body movement and to set up situations so that each student can experience success in the majority of activities practiced. Emphasis is on the basic principles of movement and their application to a variety of motor activities. The similarities between activities are stressed and the reasons for differences discussed, in the hope that the students will have some feeling of familiarity as they approach the learning of any activity in the future.

The group of students who had the basic skills instruction before entering classes in the regular activity program were compared with a group matched on motor ability and attitude toward physical education at entrance to college and A.C.E. scores, who went directly into the regular program.

Motor ability was measured by the Humiston Motor Ability Test (4) at the time of entrance to college and after the basic physical education instruction of the experimental group, and after a comparable amount of instruction of the control group in the regular physical education program.

The American Council on Education Test scores obtained from the University of Washington testing bureau were used as an indication of intelligence or scholastic aptitude.

The Wear Attitude Inventory (9) was used to measure attitude toward physical education activity at entrance to college and following each activity course. While the validity of this inventory had been established on figures obtained from college men in required classes of physical education, Dr. Wear states, "Because of the nature of the statements, it is believed that the Inventory would be equally suited for use with girls' and women's classes." (9, *p. 123*). Since the Wear inventory is based on the objectives of the regular college activity program and includes no questions which deal in any way with competition, nor any leveled at specific activities which are peculiar to the men's program, there is no reason to believe that it would be less valid for college women than for college men.

The experimenter checked the reliability and validity of the inventory with Freshman college women in the fall of 1951. On 100 cases the reliability was found to be .96, which checks exactly with that reported by Wear (9, *p. 122*). To check the validity of the inventory for women, the total score was correlated with the same self-rating scale as used in Wear's study of men, and with the results of three questions from the questionnaire used by Wear[3] in his validity study. The following results on women compare very favorably with those data obtained on men:

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[3]*Question 1:* "How important do you consider physical activity at the present time as a part of your personal recreation program?" *Question 2:* "How much of your leisure time do you devote to swimming, bowling, playing tennis, golf, or other similar sport activities?" *Question 3:* "To what extent do you like to participate in sport activities?"

	University of Washington Women	Wear's Study
Total inventory score:		
with self-rating scale	.71	.78
with question 1	.69	.64
with question 2	.32	.31
with question 3	.61	.48

From these figures it would seem that the inventory is equally valid for women. While the coefficient of correlation between the total score and the self-rating scale is slightly lower for women, that with question 3 is higher. Of the three questions, number three is most directly related to attitude, or feeling toward activity.

To gain an indication of the past experience of the students in the three activities studied (badminton, bowling, and folk dancing), a questionnaire was developed and administered to the students at entrance to college.

Skill and knowledge scores were obtained following instruction in badminton, bowling, and folk dancing. The average of the ten best scores was used to measure skill achievement in bowling; scores on the Miller Badminton Test (6), skill in badminton; and rating on skills and dances, achievement in folk dancing. Written examinations were administered at the end of each activity course.[4]

GENERAL MOTOR ABILITY IMPROVEMENT

The difference in the general motor ability of the experimental group following instruction in the basic physical education course and that of the control group after the same amount[5] of instruction in the regular activity program was studied and tested for significance.

ATTITUDE CHANGE

The change in attitude toward physical education of the two groups during these same periods was also studied. The means of the attitude scores of the experimental and control groups at the end of six credits of physical education activity were compared and the difference tested for significance. The difference in the attitude change of the low motor ability students of the various instructors in the physical education department and in the different activities was studied to determine whether activity and instructor influence are factors in any difference in attitude of the two groups.

SKILL AND KNOWLEDGE ACHIEVED

The skill and knowledge achieved by the experimental group at the end of one quarter of instruction in badminton, bowling and folk dancing were compared with those of the control. These three activities were chosen for study for the following reasons:

[4]The reliability and validity of the measures are reported in detail in the dissertation.
[5]Approximately 40 hours of instruction.

A. They make varied demands on the student because of basic differences in execution.

1. Bowling
   (a) Force is imparted to an object held in the hand.
   (b) The movement of the feet must be timed with the swing of this object.
   (c) Accuracy is restricted to a specific small area.
2. Badminton
   (a) Force is imparted to a moving object by means of an implement held in the hand.
   (b) The movement of the feet and the swing of the racket must be timed with an approaching object.
   (c) Accuracy is necessary only within a larger area.
3. Folk Dance
   (a) Force is directed toward the movement of the student's own body.
   (b) The movement must be timed in relation to established rhythmic patterns.
   (c) Accuracy involves the movement of self in relation to other people, both stationary and moving.

B. Past studies at the University of Washington indicate that the enrollment of low motor ability students is likely to be greater in these activities than in the other 16 offered by the department.

As stated previously the experimental and control groups were equated on the basis of general motor ability and attitude toward physical education at entrance to college, and A.C.E. Test score.

It was found that of the students who had had the basic physical education instruction, and for whom all of these measurements were available, 25 had instruction in bowling, 16 in badminton, and 15 in folk dancing. These students made up the experimental groups for this study.

Control groups in each activity were matched with the groups of students who had had instruction in the basic physical education curriculum on the above factors.

In order to keep instructor influence constant, an attempt was made to equate as nearly as possible the number of students of each instructor in each experimental and control group.

Other low motor ability students, both those who had and those who had not had the basic physical education class, had taken courses in these three activities. However, no attitude nor past experience index scores were available for these students. Since the groups of students for whom all measurements were available were so small, scores for these students were added to the previous groups to determine whether the same trends would be apparent with the larger groups. The means of these larger groups were tested to

determine whether the experimental and control groups were significantly different in original motor ability and A.C.E. scores.

To complete the study of the difference between the experimental and control groups in skill and knowledge following one quarter of instruction in the regular activity program, the measurements of those students in the experimental groups in the three activities were combined. This gave an experimental group of 56 students for whom all measurements were available (bowling, 25; badminton, 16; folk dancing, 15) and one of 93 students for whom motor ability and A.C.E. scores were the only equating factors (bowling, 36; badminton, 32; folk dancing, 25). In the same way scores for the control groups were combined. To determine whether these larger groups were matched in original motor ability, A.C.E. scores, and (for the groups of 56) attitude at entrance to the university, any differences between means of the experimental and control groups were tested for significance.

Since the skill and knowledge scores varied in the three different activities it was necessary to change these to standard scores for this study of the combined groups.

To compare the skill gained by the experimental group in bowling, badminton and folk dancing with that of the control group, the mean skill scores, standard deviations, and sigmas of the means were computed. The differences between the means of the control and experimental groups were tested for significance by the "t" test.[6] This procedure was carried out in each activity for the small groups who were matched on the basis of all three factors (motor ability, attitude, A.C.E.), for the larger groups who were matched only in motor ability and A.C.E. scores, and for the large combined experimental and control groups.

To determine whether the past experience of the groups in these activities could be a factor in the difference between the groups, the past experience indices of those groups for whom this measurement was available were studied. The means of the past experience indices, standard deviations, and sigmas of the means were computed for the experimental and control groups. The differences between means of these two groups were tested for significance.

Activity influence was kept constant since the same number of students in the experimental and control groups was involved in each activity. Since there was a slight difference in the number of students in the experimental and control groups taught by certain instructors, it was necessary to determine whether there was a significant difference in the skill achieved by all the low motor students of these particular instructors. The average skill score of all low motor students (both experimental and control) taught by these instructors was calculated and any differences which favored the experimental group were tested for significance.

[6]Small sample statistics were used for groups under 30.

The above procedure was repeated using the scores on the knowledge examinations in place of the skill scores.

STUDENT EVALUATION

Students evaluated the course in anonymous written evaluations immediately following the course and in interviews a year and a half later.

Results

GENERAL MOTOR ABILITY IMPROVEMENT

The results show that the experimental group have a lower[7] mean score on the general motor ability test at the end of the basic physical education course than have the control group after the same amount of instruction in the regular physical education activity program (see Table 1). In the basic course, with the exception of instruction in running, there is no instruction which deals specifically with any activity involved in the Humiston Motor Ability Test.

TABLE 1

Comparison of Means of Original and Final Motor Ability Test Scores of Experimental and Control Groups

Test	No.	Mean	σ	σ_m	Diff.	t	Level of Signif.
Original Test							
Experimental	41	62.60	3.94	.62	.34	.32	74%
Control	41	62.26	5.34	.83			
Final Test[1]							
Experimental	41	52.90	4.47	.70	3.05	2.82	1%
Control	41	55.95	5.16	.81			

[1]After basic physical education for the experimental group and the same amount (approximately 40 hours) of instruction in the regular activity program for the control group.

However, every attempt is made to gain an understanding on the part of the students of the principles of efficient body movement and their application to a variety of sports and everyday activities in the hope that the students will be able to apply them in any motor situation that they may encounter. Since the students who have this instruction improve their mean score on the general motor ability test more than those who do not, they apparently are able to make some application of what they have learned, in executing the various activities involved in this test. The improvement may also be due to more self-confidence on the part of these students in attempting a motor test after a class which has emphasized their ability to improve their performance of basic motor skills.

ATTITUDE CHANGE

While the attitude of the experimental group toward physical education is only slightly higher at the end of the basic physical education course than

[7]Since this is a time score, the lower score is better.

that of the control group after an equal amount of instruction in the regular program, it improves more during this instruction than does that of the control group in the regular program, though this difference is not statistically significant (see Table 2). However, it is found that the attitude of the experimental group continues to improve as these students go on through other activities in the program so that after six credits of physical education activity their attitude mean is significantly higher than that of the control group.

TABLE 2

Difference in Attitude Means of Experimental and Control Groups

Group	No.	Mean	σ	σ_m	Diff.	t	Level of Signif.
Original Attitude							
Exp.	28	144.4	19.0	3.59	9.1	1.65	10%
Con.	27	153.5	21.0	4.04			
Attitude after Two Credits of Physical Education (after basic physical education for the experimental group)							
Exp.	28	151.5	20.1	3.80	1.4[1]	.22	80%
Con.	27	150.1	25.2	4.85			
Final Attitude Score (after six credits of physical education)							
Exp.	28	159.5	21.5	4.06	13.2[1]	2.24	3%
Con.	27	146.2	21.1	4.06			

[1]Experimental group mean is higher.

To determine whether this difference between the experimental and control groups could be due to the influence of various activities, the numbers and percentages of the two groups taking each activity were compared. The results show that approximately the same percentage of each group is involved in each activity. Swimming, modern dance, and tennis are the only activities in which there is a difference in percentage as great as five.

A study of all low motor ability students enrolled in these activities reveals that the mean attitude change of those taking swimming is significantly higher than that of those enrolled in folk dancing (2% level) and golf (1% level), and that the mean attitude change of those in bowling, modern dance, and tennis is greater than that of those in golf, but these differences are not highly significant.

Of the activities in which more of the experimental group enrolled, swimming and modern dance tend to improve students' attitudes toward physical education activity. Of the activities in which more of the control group enrolled, tennis and archery seem to improve attitude.

In considering the three activities (swimming, modern dance, and tennis) for which there is any amount of difference in the percentage of the experimental and control groups involved, it is found that all tend to improve attitude. The experimental group has the higher percentage in swimming and modern dance while the control per cent is higher in tennis. The only ac-

tivities to which any of these is significantly superior are golf and folk dancing, and there is a slightly higher percentage of the experimental group in folk dancing and the same percentage of both groups in golf.

From these results, it would seem that a particular activity or group of activities is not responsible for any difference between the experimental and control groups in change of attitude toward physical education activity.

To determine whether instructor influence is a factor in the attitude improvement of the two groups, the number and percentage of each group who had instruction from various members of the physical education staff were calculated.

The results show that only in the case of instructors A, E, J, M, and N is the difference in percentage of the two groups as great as five. Instructors A, E and N taught more students in the control group and J and M more in the experimental group. In studying the change in students' attitudes toward physical education activity during instruction by various instructors, it is found that the mean attitude score of the students of all of these instructors, with the exception of E, improved. However, the differences between the change in E's students' mean attitude score and that of the other instructors is not significant.

The results indicate that a particular instructor is not a factor in any superiority in attitude change of the experimental group over the control. Apparently the more individualized instruction that is possible in the basic classes, the emphasis on understanding and the detailed evaluation procedures throughout the course give the students a better feeling about participation in activity.

SKILL AND KNOWLEDGE ACHIEVED

It is found that the total experimental group gains a higher level of skill and knowledge after one quarter of instruction in badminton, bowling, or folk dancing than does the control group. When the results of the small groups in each activity are studied, the superiority of the experimental groups is not great enough to prove statistically significant in most instances (see Tables 3 and 4). The differences between the skill means of the experimental and control groups are more nearly significant in badminton and bowling than in folk dancing, while the differences between knowledge means of the two groups are more nearly significant in folk dancing and bowling than in badminton. However, when the results for the three activities are combined the superiority of the experimental group is significant in both skill and knowledge.

The low motor ability students who have the basic physical education instruction are able to approach the skill T-Score mean (50) of all students taking beginning bowling and folk dancing, and to equal or slightly surpass their knowledge T-Score means in all the activities (see Table 5). Those of equally low motor ability and equal attitude at entrance to college and equal

TABLE 3

Significance of Difference in Mean Skill Scores Achieved by Experimental and Control Groups

Group	Matched in Motor Ability, Attitude and A.C.E.			Matched in Motor Ability and A.C.E.		
	No.	Mean	Signif. of Diff.	No.	Mean	Signif. of Diff.
Badminton						
Exp.	16	32.8	2%	32	32.6	11%
Con.	16	25.1		32	28.7	
Bowling						
Exp.	25	96.8	12%	36	95.7	8%
Con.	25	89.6		36	89.3	
Folk Dancing						
Exp.	15	51.5	43%	25	52.1	17%
Con.	15	48.5		25	48.0	
Combined Group (T-scores)						
Exp.	56	47.5	1.3%	93	47.0	1%
Con.	56	42.8		93	43.2	

TABLE 4

Significance of Difference in Mean Knowledge Scores[1] Achieved by Experimental and Control Groups

Group	Matched in Motor Ability, Attitude and A.C.E.			Matched in Motor Ability and A.C.E.		
	No.	Mean	Signif. of Diff.	No.	Mean	Signif. of Diff.
Badminton						
Exp.	16	25.6	21%	32	26.0	28%
Con.	16	30.4		32	29.0	
Bowling						
Exp.	25	14.9	3%	36	16.6	8%
Con.	25	20.6		36	20.2	
Folk Dancing						
Exp.	15	14.1	7%	25	16.1	3%
Con.	15	21.5		25	24.2	
Combined Group (T-scores)						
Exp.	56	52.1	1%	93	50.6	1%
Con.	56	45.7		93	45.7	

[1]Lower score is better.

TABLE 5

Mean T-Scores for All Low Motor Ability Groups in Badminton, Bowling, and Folk Dancing

Group	Badminton		Bowling		Folk Dancing	
	No.	Mean	No.	Mean	No.	Mean
Skill Scores						
Exp.	32	44.3	36	48.1	25	49.0
Con.	32	41.3	36	43.8	25	44.6
Knowledge Scores						
Exp.	32	50.6	36	49.8	25	51.9
Con.	32	47.7	36	45.3	25	43.9

A.C.E. score who go directly into the regular activity program are less able to compete with the total group in both skill and knowledge.

In comparing the past experience of the control and experimental groups the only significant difference that is found is in badminton. Since it is the control group that has had the greater past experience in badminton, it would appear that past experience is not a factor in the superiority of the experimental group.

Another factor which presumably could cause a difference between the two groups is the instruction of the various members of the physical education department.

It is found that there are only a few instances in which the differences in number in the two groups taught by an instructor exceeds two. The greatest difference is apparent in the folk dancing groups. However, the difference between the skill means of the students of these instructors is not significant.

When the differences between knowledge means of the low motor ability students of various instructors are studied, the same results are apparent. None of the differences proves significant.

When the combined groups are considered, it is found that instructors A and M taught a slightly higher number of the experimental group while instructors E and K taught slightly more of the control group. The mean T-scores of the low motor ability students of these instructors are shown in Table 6. While the mean knowledge T-score of the students of instructor E (taught more of the control group) is lower than that of either instructor A or M, these differences do not prove to be significant. The results indicate that instructor difference has little effect on the difference between the experimental and control groups in skill and knowledge at the end of one quarter of instruction in badminton, bowling, or folk dancing.

TABLE 6

Mean T-Score of Low Motor Students Taught by Various Instructors

Method	Instructor	All Measurements Available[1]		Attitude Not Available[2]	
		No.	Mean	No.	Mean
Skill					
Taught more	A	35	43.5	44	43.6
experimental	M	10	46.1	20	46.9
Taught more	E	10	43.9	11	41.4
control	K	21	48.3	33	48.7
Knowledge					
Taught more	A	35	48.8	44	47.6
experimental	M	10	49.6	20	49.2
Taught more	E	10	45.1	11	43.1
control	K	21	51.1	33	48.4

[1]Groups of 56 experimental and 56 control.
[2]Groups of 93 experimental and 93 control.

The difference between the control and experimental groups in skill and knowledge achieved is great enough to be significant when the large groups are considered and the trend is consistently in favor of the experimental group regardless of activity. Since motor ability at entrance to college, attitude, A.C.E., past experience, and instructors are not factors in this difference, it can be assumed that the basic physical education class does help the low motor ability student to gain a slightly higher level of skill and knowledge than would be possible without the instruction. Whether this greater skill achieved by the experimental group is responsible for the improved attitude, or a better and more self-assured attitude for the greater skill achieved, is a question. Either may be due to the students' gaining an understanding of body mechanics, or to their experiencing success in motor situations, or both.

STUDENT EVALUATION

The student reaction to the course, both in anonymous written evaluations and in interviews a year and a half later, is highly favorable. The students feel that the course is of value and should be offered to entering Freshman women.

Of the 145 students who wrote short evaluations of the basic physical education class at the end of the course, only one indicated that she did not appreciate the course.

Of the 41 students interviewed after completing several classes in the regular physical education activity program, all but one (98%) responded that they felt that the course had been of help to them. Ninety-five per cent replied that they thought that it was worthwhile to continue to offer the course to incoming Freshmen, one student (2.5%) replied that she was not sure, and one student said that she thought that it was not worthwhile. The instruction in relaxation was mentioned most frequently as being of value. The general understanding of basic principles of movement gained in the basic course was mentioned by the next highest number of students interviewed.

Conclusion

Within the limitations of this study, the following conclusions seem justified:

1. The general motor ability of the low motor ability students can be improved to a greater degree through instruction in the basic physical education course than through the same amount of instruction in the regular activity program.

2. The background of basic physical education instruction seems to be important in improving the attitude toward physical education of the low motor ability students as they receive subsequent instruction in the activity courses in the regular physical education program.

3. Those students of low motor ability who receive instruction in basic physical education previous to instruction in beginning badminton, bowling, or folk dancing seem to have greater success in gaining skill and knowledge

in these activities than do those of equal motor ability who enter these courses without the preliminary instruction.

REFERENCES

1. Fink, Jane Christy. *The Progress of Girls of Low Motor Ability in a Basic Skills Physical Education Program.* Unpublished Master's thesis, State University of Iowa, 1947. 40pp.
2. Fox, Katherine. Beginning Badminton Written Examination, *Research Quarterly* **24**: 135-147 (May 1953).
3. Frey, Bernice Gertrude. *A Study of Teaching Procedures in Selected Physical Education Activities for College Women of Low Motor Ability.* Ph.D. dissertation, State University of Iowa, 1947. 105pp.
4. Humiston, Dorothy. *A Measurement of Motor Ability in College Women.* Ph.D. dissertation, New York University, 1936. *Research Quarterly* **8**: 181-185 (May 1937).
5. Lafuze, Marion, A Study of the Learning of Fundamental Skills of College Freshman Women of Low Motor Ability, *Research Quarterly* **22**: 149-157 (May 1951).
6. Miller, Frances A., A Badminton Wall Volley Test, *Research Quarterly* **22**: 208-213 (May 1951).
7. Salit, Elizabeth Powell. *The Development of Fundamental Sports Skills in Freshman College Women of Low Motor Ability,* Ph.D. dissertation, State University of Iowa, 1944. *Research Quarterly* **15**: 330-339 (Dec. 1944).
8. Snell, Catherine Caroline. *A Study of Rates of Learning in Selected Sports as Related to General Motor Ability.* Ph.D. dissertation, State University of Iowa, 1948. 83pp.
9. Wear, Carlos L. *The Evaluation of Attitude Towards Physical Education as an Activity Course.* Ph.D. dissertation, State University of Iowa, 1950. iv+96 pp. *Research Quarterly* **22**: 114-126 (March 1951).

APPENDIX

Basic Physical Education Course Outline

I. OBJECTIVES

A. To develop a motor vocabulary of basic skills which are useful in everyday activities as well as those which will be useful in the activities for which the students may register during the remainder of their physical education requirements.

1. to bring about understanding of the application of the basic physical principles involved in efficient movement.
2. to provide interesting situations for the practice of various skills.
3. to make clear the interrelationships of activities.

B. To develop the ability to relax at will.

1. to give practice to relaxing the entire body.
2. to give practice in relaxing parts of the body while other parts are working.

C. To develop the students' self-confidence in their ability to control their bodies.

1. to give practice in some simple skills and to present the more difficult skills in a manner and at a speed appropriate for the class.
2. to provide methods of evaluation which will make improvement obvious to the students.
3. to give encouragement and praise.

D. To break down the dislike of activity in general and physical education in particular which has been built up because of previous feelings of inadequacy.

1. to provide a friendly informal atmosphere.

2. to express a spirit of understanding and helpfulness at all times.
3. to develop self-confidence (see C. above).

II. CURRICULUM (summary)

A. Relaxation

B. Strength Exercises

C. Co-ordination Exercises

D. Basic Motor Skills

1. Skills Presented

Standing; walking; running; stopping and changing directions; jumping and landing; throwing and catching (fleece ball, softball, volleyball, basketball); striking (volleyball serve and volley, tennis forehand, badminton forehand, golf swing); pushing, pulling; lifting; carrying; falling.

2. Method of Presentation

(a) Discussion

(1) Basic mechanical principles—presented in language understandable to the group with examples within the experience of the group.

(2) Likeness to other skills—relationships between different activities—reasons for differences.

(b) Practice of each skill

(c) Use of skill in a very simple "game situation" (relays, etc.).

III. EVALUATION

Carried on throughout the course.

(Submitted 5-11-54)

Relation of Jump and Reach Measures of Power to Intelligence Scores and Athletic Performance

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Abstract

This article reports the relation between Jump and Reach test scores and intelligence test scores of 1013 secondary school boys, the relation between the Jump and Reach test scores of athletes and non-athletes, and the relation between Jump and Reach test scores of seven sport groups. The correlation between Jump and Reach test scores and intelligence test scores was .037. Athletes were significantly superior to non-athletes in Jump and Reach test performance. The Jump and Reach test scores of seven athletic groups indicate that power is more closely related to performance in some sports than in others.

FACTORS ESSENTIAL TO athletic performance have been the subject of much speculation and some research. Coaches often consider size, height, speed, agility, power, endurance, or a combination of these physical attributes when choosing athletic teams. The relation between physical and mental efficiency has received considerable attention. Popular opinion concerning these matters varies widely. This study was concerned with power and its relation to athletic performance and to intelligence in high school boys.

It was the purpose of this study (1) to determine the relation between a boy's ability to generate power as measured by the Jump and Reach test and his intelligence as measured by the Henmon-Nelson Tests of Mental Ability, (2) to determine the power relation between athletic and non-athletic groups, and (3) to determine the power relations between certain sport groups.

Power is defined as force times velocity.

In the Jump and Reach test the power generated is dependent upon the amount of force applied and the speed with which it is applied. The distance jumped in the test will be determined by the amount of power which the individual can generate in relation to his weight, influenced to some extent by his co-ordination. Thus the Jump and Reach test may be used as a practical measure of the effective use of power by an individual in certain situations.

Review of the Literature

Di Giovanna (5) states that there is no definite correlation between intelligence and athletic ability (r.08) or between intelligence and motor ability (r.07) in college men.

Hackensmith and Miller (8) found that University of Kentucky men participating in intramural athletics had a higher mean grade point and a higher mean intelligence quotient than those not participating.

Reals and Reess (23) studied the intelligence and scholarship of high school lettermen. They summarized their study as follows: (1) Athletes have slightly lower intelligence than non-athletes; (2) Track athletes are significantly higher in intelligence than other athletic groups; and (3) Baseball athletes as a group rank intellectually below all other groups. Even more pronounced, it would seem, is the evidence that with intelligence held constant, the scholarship of athletes is below the scholarship of non-athletes when an objective measure is the criterion.

Seegers and Postpichal (25) report a study of I.Q.'s and scores in each of five athletic events achieved by 656 boys in the public schools of Philadelphia. Half the correlations between I.Q.'s and scores in the athletic events were positive but below .40. The correlations were higher for the more complicated events but none was higher than .55. They concluded that individual variation was so great, and the forecasting utility was so small that these tendencies should not be given an individual application.

Jones (14) compared the intelligence quotients of athletic award winners in Indianapolis, Indiana, with those who had not won athletic awards. He concludes:

> (1) High school athletes are more intelligent than non-athletes; (2) there is a smaller percentage of athletes than non-athletes in the lower intelligence levels; (3) a larger percentage of the athletes than of the non-athletes is in the normal and superior groups of intelligence; (4) in the very superior and near genius groups the percentage of athletes and non-athletes is about the same.

Kulcinski (15) says:

> A definite and positive relationship exists between various degrees of intelligence of fifth and sixth grade boys and girls and the learning of fundamental muscular skills, and this relationship can be measured.
>
> The group comparisons show a significant degree of learning by the superior groups, marked superiority of the normal groups over the subnormal groups, and a high degree of superiority of the superior groups over the sub-normal groups.

Landis, Burtt, and Nichols (16) found the correlations between intelligence and four athletic events as follows: hundred yard dash, .01; running broad jump, —.03; baseball throw, .04; and fence climb, .07. They concluded that, as far as their test measured it, there was no relationship between physical efficiency and intelligence.

Rudisill (24) studied the relation of Alpha Test scores and academic grades to tracing, tapping, grip, vital capacity, and endurance of grip. The subjects were 13 men and 27 women of the University of Pittsburgh. Rudisill reports there is a tendency towards a relation between physical capacity and intelligence in men (r.47) but not in women (r.18), and between physical capacity and academic performance in women (r.43) but not in men (r—.04).

Thompson and Witryol (26) studied the relation between Otis Gamma Group Intelligence Test scores and motor learning ability as measured by a high relief finger maze. The coefficient of correlation between intelligence scores and errors made by college students was .167; between intelligence and time to learn the figure .304. The coefficients for a more widely dispersed group of intelligence quotients than those of the college students used were .739 between errors and intelligence scores and .759 between intelligence and time to learn the maze.

Halsey (9) studied Otis Test scores; academic grades; physical measures of height, weight, total strength, and vital capacity; tests of running, jumping, and climbing; and estimates of athletic skill of Wellesley College women. She found "practically no correlation between measures of mental ability on the one hand and physical traits and abilities on the other."

Van Dalen (28) in studying the play of junior high school boys and girls reports the following correlations: between intelligence quotients and Strength Index, .26; between intelligence quotients and Physical Fitness Index, .13; and between intelligence quotients and General Motor Capacity, .28.

Brace (3) makes the following statement:

> Intelligence, in terms of I.Q., of the feebleminded girls studied, has slight relationship to ability to learn gross bodily motor skills of the sport type, and this relationship appears to be partly due to motor ability and general athletic ability and is so low as to have no predictive value.

Johnson (13) made comparisons between Psychological Test scores and Johnson Test scores, between Psychological Test scores and academic grades earned by college freshmen students, and between Johnson Test scores and academic grades. Johnson concludes:

1. There is no significant relationship between physical skills as measured and mental power or general intelligence as measured r—.059.
2. There is just a meager relationship between intelligence as measured and academic grades r.476.
3. There is no significant relationship between physical skill and academic grades for men (r.068) or for women (r.075).
4. There is but a hint of relationship between skill and grades in physical education activities r.1985.
5. There is no sex difference in either physical skill or academic achievement.

Vickers, Poyntz, and Baum (29) report that a high Brace Motor Ability score was associated with good abdominal muscles and high intelligence and was found to be inversely related to obesity in children.

Tuttle and Beebee (27) studied the scholastic attainment of letter winners at the State University of Iowa and report as follows:

1. The scholastic attainment of letter winners is approximately equal to the average of the male group to which they belong.
2. The correlation between the ranks assigned by the placement scores and grade point averages is approximately .80.
3. The sports on which the most emphasis is placed rank lowest in scholastic attainment.
4. Scholastic averages in all sports move down during the season of competition. . . .

5. The data indicate that scholastic attainment and athletic success are directly related. . . .

Meserve (20) compared Brace Motor Ability Test scores of normal boys with Stanford-Binet and Otis Group Test scores and found a correlation of .318.

Ilsley (12) correlated measurements of 358 men students at Pomona College. He reports a correlation of .045 between physical fitness and intelligence quotient; an r—.119 between physical fitness and height; an r.108 between physical fitness and agility score; an r—.064 between physical fitness and weight; an r.049 between physical fitness and scholastic record.

Ray (22) determined the ten possible correlations among mental ability, mental achievement, physical ability, physical achievement, and citizenship achievement of high school boys. His subjects were divided into four I.Q. levels. Of the forty correlations reported, there was one of .76 between mental achievement and motor achievement in the lowest I.Q. group and a correlation of .59 and of .54, between mental achievement and citizenship service at the highest and lowest I.Q. levels respectively. All other correlations were .33 or less.

Glassow and Broer (7) state that D. A. Sargent introduced the Sargent Jump in 1921 as an excellent measure of the explosive power of the legs. Schwegler and Englehardt in 1934 suggested a scheme whereby the number of jumps possible in 15 seconds could be scored by two formulas. One, for college men, included the sum of the successive jumps times the square root of weight divided by height. The other formula for high school boys added age to the denominator. They report reliability coefficients of .71 and .76 for the test and validity coefficients of .79 for men and .63 for boys.

L. W. Sargent, Bovard and Cozens, and McCloy conclude from their experimentation with the Sargent Jump that there is probably no advantage in using height and weight in the formula for determining performance in the Sargent Jump. McCloy suggests also that teaching and practicing the form of the jump should precede the testing for the greatest validity of the measure.

According to McCloy (19), Bovard and Cozens found a correlation of .55 between this jump and four athletic events: the running high jump, the standing broad jump, the rope climb for speed, and the 980-yard run.

McCloy (19) studied the relations between the Sargent Jump and four track and field events involving power. A reliability coefficient of .890 was obtained for the four events and one of .854 for the Sargent Jump. He states that in a number of studies the Sargent Jump was found to correlate with track and field events for men and boys from .65 to .75. He also states that the "chalk jump" has been suggested and used as a substitute for the Sargent Jump as a measure of power.

Procedure

One thousand thirteen boys of the Allentown, Pennsylvania, Public High School were tested. A jump and reach board with horizontal lines one inch

apart was placed on the wall. The person tested was placed close to the wall, face in, feet together and flat on the floor, with arm extended to the maximum height to obtain his standing reach. He was, in preparation for the jump, instructed to stand with his reaching arm next to the wall and to jump and mark the height of his jump with the same arm next to the wall. The amount of squat or dip used preparatory to jumping was optional.

The difference between his standing reach and jumping height was recorded as his power score. The best of three jumps was recorded as the score. The subjects were familiar with the test because it was a part of their physical education testing program but were allowed to practice the jump if they desired to do so.

The Henmon-Nelson Tests of Mental Ability were used. These tests, designed for junior and senior high school students, were given and scored by the regular testing personnel at the school.

Results

RELATION OF POWER AND INTELLIGENCE

The scores for both power and intelligence were plotted. These curves closely approximated that of the curve of normal distribution.

The coefficient of correlation between the Jump and Reach test scores and the intelligence test scores was computed by the formula:

$$r = \frac{\frac{\Sigma X'Y'}{N} - \left(\frac{\Sigma X'}{N}\right)\left(\frac{\Sigma Y'}{N}\right)}{\sigma_\chi \cdot \sigma_\gamma} = \frac{.436 - (-.153)\ (-.695)}{2.95 \cdot 2.99} =$$

$$\frac{.329665}{8.8205} = .037$$

This indicates that there is no relation between intelligence and power as measured in this study.

RELATION OF POWER AND ATHLETIC PERFORMANCE

Of the 1,013 boys tested, 51 were lettermen and were considered the athletic group. The other 962 were designated the non-athletic group.

The mean of the Jump and Reach test scores for the athletes was 18.74 inches and for the non-athletes was 16.80 inches. The significance of the difference between the means was determined by dividing the differences between the means by the standard error of their difference, and a critical ratio of 5.1 was found. This indicates that the difference between these groups in this power performance is statistically significant. It is therefore postulated that power as measured by the Jump and Reach test is an important component of athletic ability.

POWER RELATIONS AMONG SPORTS GROUPS

The 51 athletes were divided into seven sport groups based upon the sports in which they had lettered. Football had 20 lettermen; basketball, 9; track, 4; boxing and wrestling, 6; swimming, 5; tennis, 4; and baseball, 5. Two men were represented on more than one sport group.

The mean Jump and Reach scores for these sport groups are listed in Table 1.

The analysis of variance technique was used to test the hypothesis that the seven athletic groups were from the same population. The ratio of two independent estimates of variance, between groups and within groups, was computed. Snedecor's Table for F was consulted to determine whether or not the ratio was significant. Since the ratio was significant at the 1-per-cent level of confidence, it was apparent that the groups were not from the same population and that statistically significant differences existed among the groups. The t test was applied to determine the significance of the differences between the means of sport groups. The values of t for the differences between the means of the sports groups tested are listed in Table 1. The raised numbers following some of the values of t indicate that the differences between the means are significant at the 1- or 5-per-cent levels of confidence.

The superiority of the Jump and Reach scores of the track men, swimmers, basketball players, and football players over the boxers and wrestlers was found to be significant at the 1-per-cent level of confidence.

TABLE 1

The Values of t for the Differences Between the Means of the Jump and Reach Test Scores of the Sport Groups Tested

Mean	Basketball 19.5″	Track 21.5″	Boxing and Wrestling 16.1″	Swimming 20.8″	Tennis 16.7″	Baseball 19.0″
18.4″ Football	1.130	2.270[5]	3.490[1]	2.180[5]	1.240	.545
19.5″ Basketball		1.270	3.270[1]	.9635	1.770	.370
21.5″ Track			3.830[1]	.4220	2.600[5]	1.510
16.1″ Boxing & Wrestling				4.050[1]	.425	2.500[5]
20.8″ Swimming					2.470[5]	1.240
16.7″ Tennis						1.390

NOTE: Raised numbers following some of the values of t indicate that the differences between the means are significant at the 1 or 5 per cent levels of confidence.

The difference between the tennis and baseball groups was not significant at the 5-per-cent level of confidence. Track men surpassed all other groups in mean score; this superiority was significant at the 5-per-cent level of confidence, or higher, only in relation to football men, tennis players, and boxers and wrestlers. At this level of confidence, the boxers and wrestlers were surpassed by all but tennis men.

The evidence indicates that power, as measured by the Jump and Reach test, is more closely associated with some sport groups than with others. It appears that power among the groups tested is more closely related to track, swimming, basketball, and baseball than to boxing and wrestling, tennis, and possibly football.

Summary and Conclusions

The Jump and Reach test of power and the Henmon-Nelson Tests of Mental Ability were given 1,013 high school boys. The boys were divided into two groups. Fifty-one who had earned athletic letters were designated the athletic group and the remaining 962 made up the non-athletic group. The athletic group was divided into seven sport groups. The relation between the power measure and the intelligence measure and the relations between the power performances of the various groups were studied.

The scores on the Jump and Reach Test of power and on the Henmon-Nelson Test of Mental Ability closely approximated the curve of normal distribution.

The correlation between intelligence and power was .037, which is too low to be predictive.

There was a significant difference (critical ratio 5.1) between the means of Jump and Reach test scores of athletes and non-athletes which indicates that power as measured by this test is closely associated with athletic success.

The differences between the power performances of the seven sport groups suggest that power is more closely associated with some sports than with others. The significance of the differences between the means of their Jump and Reach scores indicates that for these groups power is more closely associated with track, swimming, basketball, and baseball than with boxing and wrestling, tennis, and possibly football.

Wider application of these findings should be based upon larger samples.

REFERENCES

1. Abernethy, Ethel M. Correlations in Physical and Mental Growth. *Journal of Educational Psychology* **16**: 458-466 (Oct. 1925).
2. Bagley, William C. On the Correlation of Mental and Motor Ability in School Children. *American Journal of Psychology* **18**: 193-205 (Jan. 1901).
3. Brace, D. K. Motor Learning of Feeble-minded Girls. *Research Quarterly* **19**: 269-275 (Dec. 1948).
4. Cattell, Psyche. School Standing and Physical Efficiency. *School and Society* **20**: 60-64 (July 1924).
5. Di Giovanna, V. G. A Comparison of the Intelligence and Athletic Ability of College Men. *Research Quarterly* **8**: 96-106 (Oct. 1937).
6. Ehrlich, Gerald. An Analysis of Curves Underlying Some Physical Education Test Items. *Research Quarterly* **17**: 270-275 (Dec. 1946).
7. Glassow, Ruth B., and Marion R. Broer. *Measuring Achievement in Physical Education.* Philadelphia: W. B. Saunders Co., 1938, 344 pp. (p. 254).
8. Hackensmith C., W., and L. Miller. A Comparison of Academic Grades and Intelligence Scores of Participants and Non-Participants in Intramural Athletics at the University of Kentucky. *Research Quarterly* **9**: 94-99 (March 1938).

9. HALSEY, ELIZABETH. The Relation Between Various Measures of Mental and Physical Traits. *Supplement to the Research Quarterly*, Wellesley College Studies in Hygiene and Physical Education **9**: 55-56 (March 1938).
10. HEIDBREDER, EDNA. Intelligence and the Height-Weight Ratio. *Journal of Applied Psychology* **10**: 52-62 (March 1926).
11. HINRICKS, MARIE A. Some Correlations Between Health, Intelligence Quotient, Extracurricular Activities, and Scholastic Record. *Research Quarterly* **12**: 228-241 (May 1941).
12. ILSLEY, MORRILL L. Study of Correlations on Measurements of Men Students at Pomona College. *Research Quarterly* **11**: 115-118 (March 1940).
13. JOHNSON, GRANVILLE B. A Study of the Relationship that Exists Between Physical Skill as Measured, and General Intelligence of College Students. *Research Quarterly* **13**: 57-59 (March 1942).
14. JONES, ROWLAND H. A Comparison of the Intelligence of High School Athletes with Non-Athletes. *School and Society* **42**: 415-416 (Sept. 1935).
15. KULCINSKI, LOUIS E. The Relation of Intelligence to the Learning of Fundamental Muscular Skills. *Research Quarterly* **16**: 266-276 (Dec. 1945).
16. LANDIS, M. H., H. E. BURTT, and J. H. NICHOLS. The Relation Between Physical Efficiency and Intelligence. *American Physical Education Review* **28**: 220-221 (May 1923).
17. LINDQUIST, E. F. *A First Course in Statistics*. New York: Houghton Mifflin Co., 1938, 226pp.
18. ———. *Statistical Analysis in Educational Research*. New York: Houghton Mifflin Co., 1940, 266pp.
19. MCCLOY, CHARLES H. *Tests and Measurements in Health and Physical Education*. New York: F. S. Crofts and Co., 1947, 412pp.
20. MESERVE, CECILLE A. *Status of Relationship of Motor and Mental Ability*. Unpublished Master's thesis, University of New Hampshire, 1933. 57pp.
21. MURDOCK, KATHERINE, and LOUIS SULLIVAN. A Contribution to the Study of Mental and Physical Measurements in Normal Children. *American Physical Education Review* **28**: 209-215 (May 1923).
22. RAY, HOWARD C. Inter-Relationships of Physical and Mental Abilities and Achievements of High School Boys. *Research Quarterly* **11**: 129-141 (March 1940).
23. REALS, W. H., and R. G. REESS. High School Lettermen—Their Intelligence and Scholarship. *School Review* **47**: 534-539 (Sept. 1939).
24. RUDISILL, EARL S. Correlations between Physical and Motor Capacity and Intelligence. *School and Society* **18**: 178-9 (1923).
25. SEEGERS, J. C., and O. POSTPICHAL. Relation Between Intelligence and Certain Aspects of Physical Ability. *Journal of Educational Research* **30**: 104-109 (Oct. 1936).
26. THOMPSON, G. G., and SAM WITRYOL. The Relationship Between Intelligence and Motor Learning Ability, As Measured by a High Relief Finger Maze. *Journal of Psychology* **22**: 237-246 (Oct. 1946).
27. TUTTLE, W. W., and F. S. BEEBEE. A Study of the Scholastic Attainment of Letter Winners at the State University of Iowa. *Research Quarterly* **12**: 174-180 (May 1941).
28. VAN DALEN, D. B. A Study of Certain Factors in Their Relationship to the Play of Children. *Research Quarterly* **18**: 279-290 (Dec. 1947).
29. VICKERS, VERNETTE, LILLIAN POYNTZ, and MABEL P. BAUM. The Brace Scale Used with Young Children. *Research Quarterly* **13**: 299-308 (Oct. 1942).

(Submitted 3-19-54)

Two and Three-Dimensional Slide Images Used with Tachistoscopic Training Techniques in Instructing High School Football Players in Defenses[1]

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Abstract

In this study, two and three-dimensional slides were made of eight defensive formations as though viewed from six offensive positions in the line (excepting center) and the quarterback position. Two equated groups were trained tachistoscopically at 1/100 sec. with their respective slide series. The group trained with two-dimensional slides had a higher percentage of correct responses (79.3%). After slide training, when tested at one second on football defensive formations with line players, both groups were able to identify the formations with equal accuracy (approximately 95%).

IT WAS THE PURPOSE of this study to explore the possibilities of using two- and three-dimensional slide images with tachistoscopic[2] training techniques for instructing high school football players in recognition of fundamental football defenses.

It seems reasonable to believe that recognition of different play situations in football and many other sports can be taught by conducting a training program using recognition training principles as used in World War II to teach Armed Service personnel recognition of planes and ships. Some educational institutions are teaching various phases of reading, spelling, arithmetic, music, etc., by this same method of instruction. The principle of teaching and learning in this technique of flashing projected slide images on the screen is basically the same. Naturally, the contents of scenes will differ. In sports, the primary concern would be the selection of conditions which require instantaneous decisions. These situations are many and varied.

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[1]The material for this article is based on a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Physical Education at Indiana University, 1951. A patent is pending on the Instruction Method and Apparatus developed in this study. It was filed in the U. S. Patent Office January 19, 1954.

[2]A tachistoscope is an apparatus for exposing figures or other visual stimuli for a second or a fraction thereof. It may be attached to the lens mounting of most slide projectors.

In the game of football, for example, this could very well be the situation of an offensive team on the line of scrimmage and ready to put the ball in play. It is imperative that the players know what defensive pattern the opponents are using at that particular instant; so that as a team they may immediately revise any offensive maneuver that has little chance of functioning against a defense that has shifted into a new pattern.

It is very difficult to teach this kind of instant recognition using the commonly known means of instruction. For one thing, time is too short to spend the number of hours on the field that is necessary to teach instant recognition of a defense. Many other phases of the game must be taught, and, especially, the right decisions to be made after a defensive pattern is recognized. Another important issue is the amount of time in which decisions have to be made. Blackboards, charts, diagrams, etc., may prove to be good audio-visual tools, but in a training program in which they are the common means of instruction there is little or no emphasis given to instant decisions. In this study, the entire training program was conducted in a classroom environment, and a time limit was placed on every decision made.

Review of the Literature

The most thorough report of tachistoscopic techniques when using two-dimensional slides was given in research studies of the Army Air Forces (3). In this program, the flash exposure method up to speeds of 1/100 sec. was used in teaching recognition of aircraft. The principal aim of training was to develop an immediate identification of the stimulus object—airplanes, in this case.

Another program based on tachistoscopic training procedures was the one advocated by the Keystone Company of Meadville, Pennsylvania (5). In the Keystone method, the application of an outline of steps for teaching was placed in the hands of experienced teachers for their decision as to any particular emphasis to be placed on sentences, words, phrases, or on form-and-digit training. The rate of instruction was based on the ability of the subjects being taught to respond satisfactorily to images flashed at 1/100 sec.

Still another program utilizing tachistoscopic training techniques was the one advocated by Renshaw of Ohio State University for use with his Tachistoscopic Trainer in teaching reading skills (9). He believes that the method of short exposures is the most effective means of teaching reading skills, and that, through a competent training program, significant improvement in understanding what has been seen, as well as an increase in the rate at which one reads comfortably, can be accomplished. He, also, wrote that tachistoscopic training would be likely to improve other functions besides reading skill. His method of teaching made extensive use of 1/100 sec. for testing purposes.

A few studies were concerned with desirable screen illumination for different projection purposes. One investigation did report that screen illumination intensity, varying between two and one-half and ten foot-candles, did not affect recognition of briefly viewed, tachistoscopically presented figures. (1).

The more recent research concerned with short exposure experiments have centered chiefly around the learning processes involved.

One authority showed clearly that exposure time had a decisive effect on the number of repetitions needed to learn a group of figures (2). He concluded that the shorter the time, the more repetitions were needed, and that the longer the time, the fewer the necessary exposures. Another authority studied some factors involved in short exposure visual perception with special reference to aircraft recognition training (8). He concluded that the use of 1/5 sec. exposures compared to longer exposures than 1/5 sec. had no ascertainable advantage over 1-sec. exposures given in the same manner and with longer exposures than one second.

According to the literature reviewed, proponents of visual education have established the value of pictures as a means of attracting attention and arousing interest. Color is known to facilitate these processes (4). However, studies to show the effectiveness of using colored slides with tachistoscopic training techniques were not found, although it is known that color aids in obtaining quality three-dimensional scenes.

Research studies that have investigated tachistoscopic training while using three-dimensional slides was not found by the author nor was conclusive evidence available as to the correct room lighting for flashing slide images at short exposures. The literature concerning seating of subjects for tachistoscopic training revealed no evidence to support any given seating arrangement for subjects to follow (3).

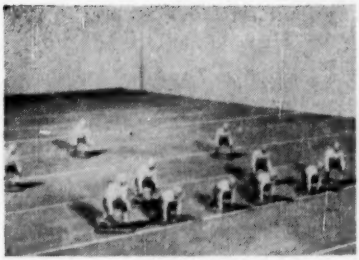
A review of the literature concerning the use of color slides may generally be summed up by saying that colored slides are considered by some authorities as being one of the newest and most promising visual aids in education (6, 7).

Production and Projection of Slides

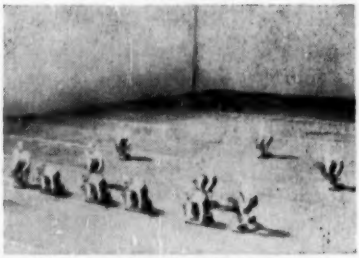
Four major steps were necessary to produce and project the slides for use in this study. First, eight football defenses were established as fundamental in accordance with the football literature. Second, a miniature field and model players were procured to be used in setting up the fundamental defenses for photographing. The application of photographic techniques necessary to obtain quality pictures was the third step, and the last step was the procurement and adaptation of projection equipment for projecting two- and three-dimensional slide images at tachistoscopic speeds.

The eight football defenses selected as fundamental were taken from 15 defenses mentioned in the football literature on the basis of frequency of use. Specific placement of individual players with a particular type of defense was established from the writings of 21 authorities.

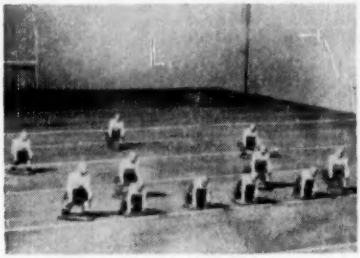
Seven offensive players' viewpoints were selected for photographing the basic views (see Figure I). A zoning guide was used to facilitate setting up positions of individual models on the miniature field for photographing each



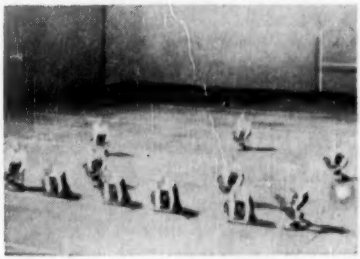
A. Left End



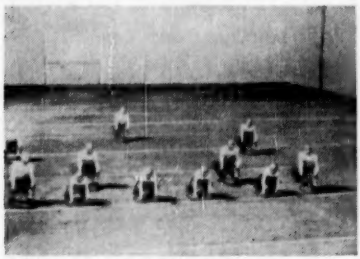
D. Right Eend



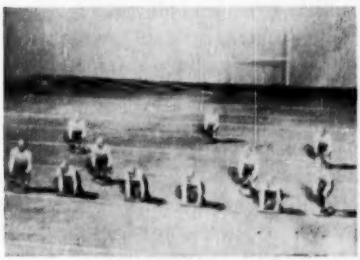
B. Left Tackle



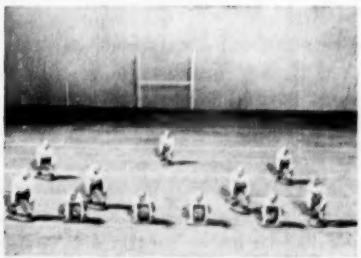
E. Right Tackle



C. Left Guard



F. Right Guard



G. Quarterback

FIGURE I. Selected Offensive Football Position Views of a 6-2-2-1 Defense as Shown by Slides.

of the eight defensive patterns. A grid drawn on the floor made possible exact placement of the camera for reproduction of any single offensive view.

In photographing the various pictures, the standards required for three-dimensional photography as determined by previous trial and error production were followed. Two exposures of the same scene, but from different camera angles, were taken which resulted in a total of 112 exposures. The finished films were mounted in permanent three-dimensional binders by the Society for Visual Education, Chicago.

The projector used in projecting the two- and three-dimensional slide images was designed by the Society of Visual Education, as a three-dimensional slide projector. Polaroid glasses were required for viewers of the three-dimensional slides. However, the two-dimensional slide images were shown by covering one of the two vertical lens characteristic of this type of projector. For short exposure equipment, two No. 3 Alphax shutters were mounted on an aluminum cover in front of each of the lenses and synchronized for simultaneous shutter releases ranging in speeds from 1 sec. to 1/100 sec. The metallic screen used for projection of the slide images was essential for three-dimensional slide image projection and was effective in two-dimensional slide projection.

Procedure

Fifty-two football squad members of Indiana University High School, Bloomington, Indiana, participated in the major training program. All pertinent factors which might reasonably be thought to be related to the learning of football defenses in the manner prescribed in this study were held constant. The two groups were matched in regard to the five traits of eyesight, position played in football, number of varsity letters earned in football, intelligence (non-language factors), and chronological age. The two latter variables were matched as regards means and standard deviations; and number of varsity letters, eyesight, and positions played were matched by arbitrarily placing equal factors in each group. Several additional factors were also held constant, such as the elimination of extra practice, 20 minute sessions for each class, and the same instructor for both groups.

After the groups were matched, 26 subjects constituted Group I, and the remaining 26 constituted Group II. By random selection, Group I was assigned the two-dimensional slide images as the medium of instruction in recognition of certain fundamental football defenses, and Group II was assigned the three-dimensional slide images as a means of instruction.

The slide filing system was arranged by number and defensive pattern to facilitate slide selection for any given session. The preparatory signals given to the subjects when flashing an image on the screen were based on the Army Air Forces recognition training program. During the training periods, all slides introducing a new defense were projected on the screen for one minute, and the advantages and disadvantages of each particular defense were dis-

cussed briefly. Sample review slides were projected for ten seconds and repeated at 1/100 sec.

Daily lesson plans were made up so that approximately every four days two new defenses chosen at random were introduced, and some reviewing was done of slides previously shown. The last two of the 18 sessions were used to give a final slide test in which each group was tested over the respective kind of slides by which instruction had been given.

Records were kept of all daily test scores as recorded by each subject. In this way, all individual recordings of slide responses were accumulated during the training program, and the percentage of correct answers was figured daily, weekly, and for the entire training program.

A frequency table of the number of times any particular slide was shown, either as a sample or test slide, allowed a balanced emphasis of use to be placed on the total of 56 slides. Also, to avoid any tendencies for memorization of a particular slide, the average projection of any one slide was not allowed to exceed a maximum of four showings. The accumulative nature of these records allowed a constant check to be made in preventing overuse of any particular number of slides covering only one type of football defense.

After the training program was completed, a "field" test was administered to the subjects in order to obtain some indication of the accuracy with which high school football players might reasonably be expected to recognize certain football defenses in a football game situation. Group I and Group II were administered the test at the same time under identical circumstances in which defenses were set up by using volunteers who had not participated in the training program. These boys were suited in football equipment and by direction formed various defensive formations which were exposed in 1-sec. flashes to the two groups that had participated in the slide training program.

Discussion of Results

Group 1 who were trained with two dimensional slides had the higher percentage of correct responses (79.3%) than Group II who were trained with three dimensional slides (72.2%).

The final slide test of 40 chances showed Group I to average 72.4 per cent of correct responses, while Group II had 61.1 per cent of correct responses. In each case, the medium by which the subjects were tested was identical to the one by which the groups had been instructed.

The groups were then tested on football defenses using live players. Both groups were able to identify the formations with approximately 95 per cent accuracy with the scenes lighted by 1-sec. flashes. Such high scores seem to indicate that high school football players may be taught to recognize fundamental football in one second of time with little difficulty after tachistoscopic training with slides.

Conclusions

These conclusions are based on the conditions under which the investiga-

tion was conducted, and apply only to the problem as stated and to the slides and procedures used in conducting the study.

1. In view of the fact that the percentage of correct responses to both two- and three-dimensional slide images throughout the entire training program was approximately 75 per cent, it appears that such an instructional method is not only feasible but also has many potentialities for the teaching of football defense recognition in a relatively short period of time and in a classroom environment.

2. Since there was only an approximate 10 per cent difference between the correct responses to both types of slides, it appears that neither type possesses distinct advantages, even though one might anticipate certain advantages for the three-dimensional slide when dealing with such a spatial arrangement as a football defensive pattern. However, from the standpoint of economy in slide production, cost of procuring suitable projection equipment, and ease of viewing, the use of two-dimensional slides appears advantageous for practical instructional purposes.

3. It appears that the degree of depth illusion portrayed by the three-dimensional slide image is not needed to teach recognition of football defenses by total pattern.

4. One one-hundredth of a second appears to be a feasible exposure time for teaching recognition of football defenses with two- and three-dimensional slide images.

5. A training program based on the procedures utilized in this study seems to pose no problem of stimulating the interest of the subjects, nor of motivating them to perform with zest.

6. The miniature model football players, field, and background, specially constructed and colored to give contrasting effects on Kodachrome film, served the intended purpose remarkably well considering the speed of one one-hundredth of a second in which the images were flashed in testing. It is, also, possible that the exactness and reality of the slides were contributory factors in arousing and maintaining interest during the training program.

7. The "field" test results indicate that high school football players can recognize with little difficulty actual football defenses set up in a "field" situation in one second of time following tachistoscopic training with slides.

Recommendations for Further Research

Since the nature of this investigation was largely exploratory, the recommendations for further research are made specifically to cover the possibilities of future studies in football.

1. Additional research should be conducted to investigate the most desirable length of time for continuing a training program using either two- or three-dimensional slide images.

2. The carry-over value of tachistoscopic training techniques when utilizing two- and three-dimensional slide images should be investigated in relation to football game situations in which individuals are under real pressure.

3. The value of black and white film versus color film for football instruction purposes when using tachistoscopic training techniques and two- and three-dimensional slides depicting football defenses should be studied.

4. The educational value of teaching the judgment of specific distances with regard to spatial relationships of individual defensive players should be explored. Research of this kind, done in conjunction with tachistoscopic training and utilizing three-dimensional slide views, should indicate the possibilities involved in players' being taught to recognize quickly where their opponents, as individuals, are stationed.

5. Studies to test the effectiveness of teaching other phases or the game of football by recognition training procedures should be investigated.

6. Research could be done to show whether there is any relationship between skill in recognition and such traits as intelligence (non-language), chronological age, and the football experience of a particular player.

7. A study to establish the relationship between skill in slide recognition and skill in football defense recognition in a "field" situation would be of considerable value.

8. The three-dimensional slide produced by the Vectograph[3] method should be investigated, particularly since a Vectograph slide (3 in. by 4¼ in.) can be projected in a regular two-dimensional slide projector.

REFERENCES

1. Carmichael, Leonard, and Walter F. Dearborn, *Reading and Visual Fatigue*, Boston: Houghton Mifflin Co., 483 pp., 1947.
2. Ferher, Elizabeth V., An Investigation of the Learning of Visually Perceived Forms, *American Journal of Psychology*, **47**: 187-221 (April 1935).
3. Gibson, James J. *Motion Picture Testing and Research Report No. 7*, Army Air Forces, Aviation Psychology Program, 1947, 267 pp.
4. Hennen, Louise Reiner. *A Study of the Effect on Children's Choices of Adding Color to Illustrations.* Unpublished Master's thesis, West Virginia University, 1936, 141 pp.
5. Keystone School and Guidance Center. *The Keystone Tachistoscope: Advanced Teaching Techniques*, Keystone View Co., Meadville, Pa. 1950, 42 pp.
6. Lewerenz, Alfred S., The Education Effect of Coloring Stereoptican Slides, *Educational Research Bulletin* **8**: 8-13, Los Angeles, October 14, 1928.
7. Long, Author Lee *The Influence of Color on Acquisition and Retention as Evidenced by the Use of Sound Films.* Unpublished Doctor's thesis, University of Colorado, 1945, 140 pp.
8. Luborsky, Lester B. *Some Factors Involved in Short Exposure Visual Perception With Special Reference to Aircraft Recognition Training.* Unpublished Doctor's thesis, Duke University, 1945, 149 pp.
9. Renshaw, Samuel K., The Visual Perception and Reproduction of Forms by Tachistoscopic Methods, *Journal of Psychology* **20**: 217-232 (1945).

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[3]Details of procedure may be obtained from the Polaroid Vectograph School in Cambridge, Massachusetts.

Prevalence of Certain Harmful Health and Safety Misconceptions Among Prospective Elementary Teachers

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Abstract

In this study a special instrument was administered to 55 prospective elementary school teachers. The instrument was designed to determine the prevalence of 216 harmful health and safety misconceptions among the group of prospective elementary school teachers and the extent to which they were aware of the harmfulness of these misconceptions. It was found that many harmful health and safety misconceptions were prevalent among the prospective elementary school teachers and that the prospective elementary school teachers who knew that certain health and safety statements were completely false were also aware of their harmfulness.

EDUCATION FACES A serious challenge in dealing with the harmful health and safety misconceptions of children (1). It has the responsibility of helping children to correct acquired health and safety misconceptions that may serve as guides to undesirable behavior. This responsibility cannot be met unless elementary school teachers recognize these misconceptions and are aware of their harmfulness.

Purpose of the Study

The purpose of this study was (1) to determine the extent to which a group of prospective elementary school teachers subscribed to certain harmful health and safety misconceptions, and (2) to determine the extent to which they were aware of the harmfulness of certain health and safety misconceptions.

Procedure

An instrument especially designed for evaluating the harmfulness of certain health and safety misconceptions was administered to a group of 55 prospective elementary school teachers. The group consisted of 14 men and 41 women who were juniors in a teacher-training institution.

The instrument was constructed by Dzenowagis (1) who had juries of experts in the fields of health and safety validate certain health and safety misconceptions and also evaluate the same misconceptions according to their degree of harmfulness.

The instrument consisted of a list of 187 health misconceptions, a list of 29 safety misconceptions, and a separate instruction sheet for evaluating the misconceptions on each list. The instruction sheet consisted of:

1. A list of possible harmful effects that might come about as a result of an individual subscribing to health and safety misconceptions. The harmful effects listed were: prevents the acquisition of true concepts; causes unnecessary worry and anxiety; wastes time and money; delays the seeking of medical treatment; serves as the basis of bad health practice; promotes fads and quackery; encourages self-medication; causes the ingestion of harmful susbtances; promotes hypochondriasis; builds up a false sense of security; promotes irrational fears; causes humiliation and embarrassment; impedes scientific and social progress; develops food aversions and fears; promotes indiscriminate use of drugs and medicines, and may be fatal if used as the basis for action.

2. Instructions for each prospective elementary school teacher to read this list of harmful effects and to rate every statement on the attached list that was completely false by checking one of the following: (1) not harmful, (2) slightly harmful, (3) moderately harmful, (4) very harmful, or (5) extremely harmful.

3. Instructions to the prospective elementary school teachers to delete any statement that in their opinion had any truth in it, or, in other words, was not completely false.

4. Instructions for the prospective elementary school teachers to rate each statement only according to the degree of harm such a misconception would engender, and not according to prevalence or possibility of occurrence.

5. Instructions for the prospective elementary school teachers to forego the evaluation of any misconception that was too unfamiliar to them.

Analysis and Treatment of Data

The data obtained in this investigation were analyzed and treated as follows:

1. A frequency distribution of the responses by prospective elementary school teachers to each misconception was made.

2. The median of the frequency distribution for each misconception was determined.

3. A comparison was made of the median rating of each health and safety misconception evaluated by the group of prospective elementary school teachers and the juries of experts (1). The comparison indicated close agreement between the jury of experts and the group of prospective elementary school teachers as to the harmfulness of 212 of the 216 misconceptions. The table showing the comparison is extensive and is, therefore, not included in this report.

4. The statements which were deleted as being not completely false by 5 per cent or more of the group of prospective elementary school teachers were listed in descending order according to prevalence. These misconceptions are presented in Tables 1 and 2 along with the harmfulness rating assigned to them by the juries of experts.

Findings

The analysis of data indicates the following to be the findings:

1. There was close agreement between the harmfulness ratings assigned to the health and safety misconceptions by the group of prospective elementary school teachers and the juries of experts.

2. Five to 60 per cent of the group of prospective elementary school teachers subscribed to 82 of the 216 health and safety misconceptions which were considered to be completely false and harmful by juries of experts.

Conclusions

On the basis of the findings of this investigation, the following conclusions seem justifiable:

1. Prospective elementary school teachers who know that certain health and safety statements are completely false are also aware of their degree of harmfulness.

2. Many harmful health and fety misconceptions are subscribed to by prospective elementary school teachers.

Recommendations

The following recommendations are worthy of consideration:

1. Extensive studies should be conducted to determine the prevalence of harmful health and safety misconceptions among other types of prospective teachers.

2. Teacher-training institutions should place more emphasis on the teaching of health to prospective school teachers.

REFERENCES

1. Dzenowagis, Joseph G. *A Determination of the Prevalence of Certain Harmful Health and Safety Misconceptions among Fifth- and Sixth-Grade Children.* Doctor's dissertation, Boston University, 1953.

APPENDIX

TABLE 1

Harmful Health Misconceptions Considered as Being Not Completely False by Five Per Cent or More of a Group of Prospective Elementary School Teachers

Health Misconceptions	Per Cents	Degree of Harmfulness[1]
(1)	(2)	(3)
1. A mouthwash is healthful because it helps kill germs in the mouth and throat	60	2
2. Cutting or shaving a person's hair makes it grow faster and thicker	55	2
3. A daily bowel movement is always necessary so a person can stay healthy	49	3
4. A good way to treat frostbite is to rub the frostbitten part with snow	42	4
5. All persons should use nose drops and mouth washes daily when they have a cold	29	3
6. Everyone who has weak feet should wear arch supports to strengthen them	27	3
7. Wearing bathing hats or ear plugs while swimming will give a person complete protection for his ears	26	3
8. Brushing your teeth every day is a sure way of stopping decay	25	3
9. It is a bad health habit to drink water while you exercise	24	2
10. The best way to treat a black eye is to put a piece of raw meat on it	22	3
11. Persons can clean their blood by eating certain foods	20	4
12. Sugar diabetes is caused by eating too much sugar	20	3
13. The only good treatment for weak arches is to have arch supports placed in the shoes	20	
14. A pain in your right side usually means that you have appendicitis	20	2
15. The only good way to lose weight is by exercising	16	3
16. There are some pills that people can take which will prevent the common cold	16	3
17. A good health rule to follow is: "Feed a cold and starve a fever"	16	3
18. Wearing eyeglasses will always make a person's eyes stronger	16	3
19. Most colds cannot be prevented	16	3
20. There are some pills that people can take which will cure the common cold	15	4
21. Any exercise is bad for persons who have heart trouble	15	3
22. There are no living germs in pasteurized milk	15	2
23. Most cases of baldness can be cured if treated early	13	3
24. Anyone who keeps his skin clean will never have pimples	13	2
25. The vitamins in certain pills are better than the vitamins in natural foods	13	3

Health Misconceptions	Per Cents	Degree of Harmfulness[1]
(1)	(2)	(3)
26. Persons should eat only when they feel hungry	13	2
27. It is impossible to cure any cancer	13	5
28. Persons who have pimples or boils usually have bad blood	11	3
29. Taking vitamin pills is the best way to get your necessary vitamins	11	3
30. Some people should drink very little water because it turns to fat in their bodies	11	4
31. Good health does not depend on what you eat	11	3
32. Wearing sunglasses will give your eyes complete protection from the sun	11	3
33. The use of tooth powders and pastes is sure to make a person's gums firm	11	3
34. Most colds can be prevented by taking vitamin pills	11	2
35. Pain near the heart is generally a sign of heart disease	11	3
36. Baldness is usually caused by wearing hats	9	2
37. People who exercise a lot live longer than other people	9	4
38. Most fat people are happy and jolly	9	3
39. Every disease needs a drug or medicine for its cure	9	4
40. People should protect themselves from catching cold by gargling with a mouth wash	9	2
41. There are certain cough medicines that will cure and prevent the common cold	9	4
42. Wanting to eat candy and sweets is always a sign that your body needs more sugar	9	3
43. Iodine is the best treatment for wounds caused by stepping on rusty nails	9	4
44. Any person who sees clearly can be sure he doesn't need glasses	9	2
45. Spring water that is clear and cold is always safe for drinking	9	4
46. The first and best thing to do in caring for a cold is to take a laxative	7	3
47. There are special laxatives that will help prevent or cure the common cold	7	4
48. Most persons who look thin are certain to be underweight and in poor health	7	3
49. Everyone who is on a diet is trying to lose weight	7	2
50. If a person wants to be strong and healthy, he should eat plenty of raw meat	7	3
51. The best way to brush your teeth is sideways	7	3
52. An all-vegetable diet is the natural and best diet	6	3
53. To go on a diet always means to eat less food	6	2
54. It is very hard for thin persons to keep from getting tuberculosis	6	3
55. Smoking is not harmful because many doctors and athletes smoke	6	3
56. Mental illness usually happens suddenly	5	4
57. It is possible to tell what is going to happen to people from their dreams	5	4
58. You can be sure anything a scientist says about health is true	5	3
59. When you walk or run, it is best to point your toes out toward the side	5	3
60. A good way to treat a black eye is to press the eye with a knife handle	5	3
61. The first thing to do in treating a burn is to put cold water on it	5	4
62. Nose drops will cure a cold which is causing a stuffy nose	5	3
63. All vegetables and fruits should be eaten raw	5	3
64. Any food that does not smell or taste spoiled is safe to eat	5	4
65. Bananas should be kept out of a good diet because they make people fat	5	2
66. People are born with their food likes and dislikes	5	2
67. Using a toothpick is the best way to get things from between your teeth	5	2

Health Misconceptions (1)	Per Cents (2)	Degree of Harmfulness[1] (3)
68. All people with rosy complexions are very healthy	5	4
69. Fat people can feel quite sure that they will never get tuberculosis	5	4
70. Mouthwashes are sure to prevent or cure diseases of the mouth and throat	5	3
71. Houseflies are harmless because they are unable to bite	5	4
72. Most colds can be cured by taking vitamin pills	5	3
73. Any person who feels all right is sure to be in good health	5	3
74. Missing a bowel movement for one day is alway a sign of constipation	5	3
75. Wearing eyeglasses will always make a person's eyes weaker	5	3

[1]A degree of harmfulness was assigned to each misconception by a jury of experts and is indicated by the following ratings:

5—Extremely Harmful
4—Very Harmful
3—Moderately Harmful
2—Slightly Harmful
1—Not Harmful

TABLE 2

Harmful Safety Misconceptions Considered as Being Not Completely False by Five Per Cent or More of a Group of Prospective Elementary School Teachers

Safety Misconceptions (1)	Per Cents (2)	Degree of Harmfulness[1] (3)
1. People should walk on the right hand side of the road if there are no sidewalks	22	4
2. It is always impossible for a person with cramps to swim	18	4
3. Bicycle riders should ride on the left-hand side of the road to be safe	16	5
4. The only good way to help a drowning person is to jump in the water to save him	15	5
5. It is usually safe to go in swimming alone if you know how to swim	13	5
6. All mad dogs foam at the mouth	9	5
7. A person always come up to the top of the water three times before he drowns	7	5

[1]A degree of harmfulness was assigned to each misconception by a jury of experts and is indicated by the following ratings:

5—Extremely Harmful
4—Very Harmful
3—Moderately Harmful
2—Slightly Harmful
1—Not Harmful

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Effects of a Combative Sport Upon Personality Dynamics as Measured by a Projective Test

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Abstract

In this exploratory study, eight college wrestlers were tested with the House-Tree-Person test of personality under three conditions: (1) before a wrestling season; (2) 4 to 5 hours before the first intercollegiate match of the season; and (3) the morning after the competition. Test interpretation revealed several group tendencies from condition to condition, outstanding among which were: decrement of functioning intelligence, increased aggressive feelings, and increased neurotic signs in the before match condition; and a return to approximately the status of condition I except for considerably less aggressive feelings in condition III.

IT IS RATHER GENERALLY assumed that sports provide an outlet for powerful emotions which are accumulated in the course of daily living;[1] and thus we speak of the "cathartic" value of sports in something of the sense intended by Aristotle when he first applied the term to what he considered to be the psychologically cleansing effect of tragic drama. Presumably, the personality "displaces" or redirects pent-up aggressions and other powerful emotions and vents them harmlessly in the controlled and socially acceptable drama of athletic competition (8, 13).

Taking another point of view, it may be argued that the cathartic effect of tragic drama derives from the frank portrayal of the culturally forbidden and violent, *and* from the terrible punishments of the transgressors; but in contrast, sports are necessarily hemmed tightly round with rules and restrictions which prevent a truly catharitic release of the emotions. And lacking punishment for overtly expressed aggressions, the aftermath of violent sports may be strong guilt feeling (7, 8, 15). Lemkau has commented on one aspect of this possibility:

> I am a little skeptical, I must admit, about whether athletics are really an outlet for aggressive feelings. It seems to me that the controls involved in game rules are so complete that there is some doubt whether basic aggression would be released in such a controlled situation. I would rather at this moment at least, say that it is a release for the drive to physical activity which certainly is not the same as aggression." (12, *p. 17*).

[1]"And so man encountering threats must continue to fear and fear and hate and hate. Opportunities to give vent to both are severely restricted in our civilized lives, and so fear and hate are turned against things other than those for which they were originally intended." (Dr. G. S. Stevenson, Medical Director, The National Assoc. for Mental Health, Inc. See ref. 24.)

One might further argue that the very restrictions and rules which define and order some sports so frustrate the venting of emotion that the immediate and perhaps ultimate effect is heightened, rather than lowered, aggressive feelings (7, 14, *p. 9ff*). Some of the savage outbursts of fist fighting in such sports as basketball and ice hockey might be evidence in support of this possibility.

None of the points of view on this subject of aggression and aggression reduction in sports have been supported by an accumulation of experimental data. More significantly, we have as yet very little information on the much broader question of the effects of the competitive sports experience upon personality dynamics in general.

The Experiment

An exploratory experiment was conducted in the hope of learning something of how participation in a violent sport affects the dynamics of personality. Wrestling was selected because of its combative nature and because it has been found to be associated with exceptional emotional stress (10).

The Personality Test. A projective personality test was utilized in the hope of penetrating into some of the more subtle and usually inaccessible aspects of personality functioning.[2] Buck's House-Tree-Person test of "total personality" (3, *p. 1*) was selected as being reasonably well suited for use in this initial inquiry because it seems to reflect the impact of strong emotion upon personality, and because the commonplace task it requires—drawing a house, a tree, and a person with crayons—has been found to be unlikely to give rise to blockages and refusals to be tested when subjects are in an emotionally disturbed state (5, *p. 118*).

Limitations of the Test. Attention is directed to the fact that although the H-T-P has been established as a promising clinical test, it shares the limitations characteristic of projective tests, especially when used for experimental rather than clinical purposes (1, *p. 29 ff.*; 17). Moreover, some aspects of the H-T-P remain on questionable grounds in terms of certain of Buck's theoretical premises; and being a relatively new test its potentialities and limitations are not fully understood (2, *Vol. II, p. 180;* 6, *p. 47*). Although the H-T-P yields various objectively derived scores, its full evaluation, like a medical diagnosis, rests to a considerable extent upon the clinical insight of the evaluator—upon his subjective interpretation of signs. It is for this reason that supporting evidence is not presented in the section of this paper on Results.

Conditions of the Research. The H-T-P test was administered to eight members of a college varsity wrestling team under three conditions: Condition I: approximately 3 weeks prior to the first intercollegiate match of the season to establish a "normal" personality evaluation for each wrestler; condition

[2]For a brief discussion of projective test theory, see the *Research Quarterly*, Dec. 1954, p. 484 (11).

II: 4 to 5 hours prior to the first interschool match of the season to determine the influence of anticipatory stress upon personality dynamics; and condition III: the morning after the competition.

Test Evaluation. The tests were evaluated quantitatively and qualitatively in accordance with the prescribed procedures (3, 4, 5). The psychologist who handled this phase of the work (and who had helped to develop the H-T-P technique) dealt with each test as though it were a clinical protocol.

Discussion

Since the test in all three conditions of the research amounted to drawing a house, a tree, and a person, it was to be expected that subjects would not make identical drawings in each repetition of the test—and that therefore the three sets of tests would necessarily differ regardless of whether or not personality dynamics had actually undergone change due to the athletic experience. However, if no intervening experience had altered personality dynamics markedly between any two tests, there would be no reason to expect systematic changes in drawings which have been found to be indicative of some personality disturbance.

For a somewhat oversimplified example: Let us suppose that in condition I, subject A draws a path containing a few small circles to suggest pebbles, but that in condition II (pre-match) when drawing a similar path this subject draws pebbles until the path is literally covered with tiny circles. Now if this were an isolated occurence in the drawings of condition II, perhaps no great meaning would be attached to it; but if other parts of the house picture and the tree and person pictures also reflect a monotonous detailing of trivia, the test evaluator might well have reason to suspect compulsive behavior—which is a common reaction of personality when in a state of anxiety (16, *p. 291 ff.*). Let us further suppose that in condition III, there is a return to something like the pattern of condition I, that is, restored concern for *significant* detail work and for the integrity of the picture as a whole; and if this tendency is reflected in the tree and the person as well, one might assume that the personality is no longer reflecting anxiety in compulsive behavior.

The evaluation procedure of this research left something to be desired in that it was not possible for the evaluator to approach the tests in complete ignorance of the research purpose or plan. However, he did not know what type of sport was involved or between which two tests the intervening experience had occurred. Moreover, he had had virtually no interest in or contact with athletic sports, nor had he had occasion to form specific opinions as to the effects of sports competition upon personality dynamics.

Findings

Analysis and comparison of the tests revealed several group tendencies from condition to condition, outstanding among which were the following.

1. In condition II (pre-match), the level of functioning intelligence of the group dropped from an estimated high average (mean I.Q. of 110) to low

average (mean I.Q. of 92). There were strong indications of heightened anxiety; and increased neurotic tendencies were noted, including compulsiveness and markedly heightened body consciousness. Aggressive feelings were much more in evidence, but the subjects showed an increased tendency to hold these feelings within strict controls and to direct them inwardly ("intrapunitive aggression") rather than against persons or things in the environment ("extrapunitive aggression").

2. In condition III (post-match), functioning intelligence returned to or near its condition I levels. The neurotic tendencies noted in condition II were no longer in evidence. Aggressive feelings were greatly reduced, in most cases to levels below condition I, whether or not the subjects had won in their matches.

Certain observations were made as to the characteristics of the group under "normal" conditions (condition I). The subjects were described as evidencing a greater degree of aggressiveness or pent-up feelings of hostility than is ordinarily found. Seven of the subjects seemed to have little difficulty expressing their aggressive feelings in their drawings. One subject seemed disturbed by his own feelings of aggression and tended to direct them towards himself rather than outwardly.

Observations were also made regarding the characteristics (in condition I) of three wrestlers of exceptional ability, one of whom was not a member of the experimental group. (The test evaluator was not informed as to the ability of these subject.) All three were extremely aggressive, gave evidence of exceptional "drive" to be successful, and had strong feelings of self-assurance. They also gave evidence of more generalized and more conscious anxiety than is common. The "constriction of personality" (e.g., lowered functioning intelligence and increased neurotic signs) that was so apparent in the rest of the group in condition II was considerably less in evidence in the two outstanding wrestlers.[8]

Summary and Conclusions

Eight college wrestlers were tested with the H-T-P projective test of personality under three conditions: before the wrestling season (assumed to represent a "normal" measure for each subject); 4 to 5 hours before the first intercollegiate match of the season; and the morning after the competition. Interpretation of the tests revealed several group tendencies from condition to condition, outstanding among which were: decrement of functioning intelligence, increased aggressive feelings (especially intrapunitive), and increased neurotic signs in the before match condition; and a return to approximately the status of condition I except for considerably less aggressive feelings in condition III.

[8]The observations of the exceptional personality traits of the outstanding wrestlers suggested a subsequent study of athletic champions in which two projective tests were used, the Rorschach as well as the H-T-P. See reference 11.

The experiment was frankly exploratory, the intention being to determine whether the projective technique is a promising tool for studying the effects of athletic competition upon personality dynamics. In spite of certain obvious weaknesses in research technique, the results of the study seemed encouraging to the present writers, and have led to work in similar vein (9, 11).

The present research indicates that the subjects experienced something of a cathartic effect whether or not they won; however, this should certainly not be taken to invalidate Lemkau's argument in relation to sports in general. Findings in condition II (pre-match) seemed interesting in that they suggested the extent and nature of personality disturbance, referred to as "general constriction of personality" by the clinician, involved in anticipating a combative (but relatively very safe) sport.

The researchers concluded that the projective test technique is deserving of further study as a means of evaluating the effects of sports competition upon the dynamics of personality at all age levels.

REFERENCES

1. Anderson, H. H. and G. L. Anderson, *Introduction to Projective Techniques.* New York: Prentice-Hall, Inc., 1951.
2. Brower, D. and L. E. Abt, *Progress in Clinical Psychology,* Vol. I & II. New York: Grune and Stratton, 1952.
3. Buck, J. N., *Administration and Interpretation of the H-T-P Test,* Proceedings of the H-T-P Workshop, Veterans Administration Hospital, Richmond, Virginia, 1950.
4. ———, The Quality of the Quantity of the H-T-P, *J. of Clinical Psych.* **7**: 352-356, Oct. 1952.
5. ———, The H.T.P. Scoring Manual, Monograph Supplement No. 5, *J. of Clinical Psych.,* Oct. 1948.
6. Buros, O. K., *The Third Mental Measurement Year Book.* New Brunswick: Rutgers University Press, 1949.
7. Dollard, J. and N. E. Miller, *et al, Frustration and Aggression.* New Haven: Yale University Press, 1939.
8. Gardener, G. E., Recreation's Part in Mental Health, *Recreation,* Jan. 1952.
9. Husman, B., *An Analysis of Aggression in Boxers, Wrestlers, and Cross Country Runners as Measured by the Rosenzweig P-F Study, Selected TAT Pictures, and a Sentence Completion Test,* Doctoral dissertation, University of Maryland, 1954.
10. Johnson, W. R., "Emotion Reveal in Two Types of Athletic Contests," *Research Quarterly,* **20**: 72-79, March 1949.
11. ———, D. C. Hutton, and G. B. Johnson, Jr., Personality Traits of Some Champion Athletes as Measured by Two Projective Tests: Rorschach and H-T-P, *Research Quarterly,* **25**: 484-485, Dec. 1954.
12. Lemkau, P. V., quotation in *Desirable Athletic Competition for Children.* Washington, D. C.: American Association for Health, Physical Education and Recreation (NEA), 1952.
13. Menninger, W. C., Recreation and Mental Health, *Recreation,* 1948.
14. Stevenson, G. S., *Introduction to L. Freeman's Fight Against Fears.* New York: Crown Publishers, 1951.
15. Stone, A., The Catharsis Theory of Aggression, *Lab. Bulletin,* Laboratory of Social Relations, Harvard University, **2**: 9-13, June 1950.
16. White, R. W., *The Abnormal Personality,* New York: The Ronald Press, 1948.
17. Zubin, J., Objective Evaluation of Personality Tests, *Am. J. of Psychiatry,* **107**: 569 ff., Feb. 1951.

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Relationship of Body Weight to Strength Body Weight Ratio in Championship Weightlifters

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Abstract

Analysis of the body weight to the strength/weight ratio in 121 championship weightlifters shows a linear decrease in proportionate strength with increasing body weight for the weight classes 132 to 198 pounds. The greater agility and endurance usually found in smaller men may be the result of this phenomenon. Proportion of muscle tissue in the body, ratio of contractile to structural proteins in the muscle, or favorable skeletal proportions are suggested as some of the possible causes.

THE SMALL VOLUME OF the research literature in physical education dealing with the strength/body weight ratio indicates that this may well be a concept of considerable significance in the area of physical fitness testing. Cureton has analyzed the effect of age on this ratio, and demonstrated by factorial analysis that it is associated with metabolic rate and thinness. He has also shown it to be highly correlated with all around motor fitness (2).

In spite of the possible importance of this ratio there has been no investigation of its variation with body weight in the American or English literature. Mention is made by Karpovich (4) of a Russian report appearing in *Fiziologia Sporta*, describing an experiment on Russian weightlifters. It was found that the small lifters performed better on a back and arm strength test than did the larger. This finding is in accordance with observations of followers of competitive weightlifting, for it has been a matter of common knowledge that lifters in the lighter body weight divisions are stronger pound for pound than the men in the heavier classes (5). However, such observations require quantitative measurement before being accepted as scientifically validated.

It appears that this relationship is of sufficient interest and significance to warrant the application of such methods. Hence, in order to initiate a more inclusive investigation and to add to the information available on the subject an analysis of the strength/body weight ratio as it appears in two groups of championship weight lifters has been attempted.

Method

The data for this study were composed of the records of: (a) Seven world

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champion weightlifters in the various body weight classes, and (b) 114 competitors in the Olympic Weightlifting Championships.

Contestants in weightlifting competition are classified according to weight into the following seven groups: 123 pounds and under; 124 to 132 pounds; 133 to 148 pounds; 149 to 165 pounds; 166 to 181 pounds; 182 to 198 pounds; unlimited.

Scores are calculated by totaling the poundage lifted overhead by each of three methods, or "lifts": the Two Hands Clean and Jerk, the Two Hands Military Press, and the Two Hands Snatch. In the first of these lifts, the bar is laid horizontally in front of the feet, gripped with both hands and brought with a single distinct motion from the ground to a resting position on the chest or flexed arms. The feet are brought to a parallel position so that an erect body posture is assumed. Then the legs are bent and both arms and legs straightened with a rapid jerk, thus lifting the bar to full arms-length overhead. The initial movement of the Two Hands Military Press is accomplished in the same manner; however, after the standing position is attained with the bar resting in front of the shoulders, no movement is permitted for two full seconds. The bar is then lifted to arms-length overhead with a slow even push. In performing the Two Hands Snatch, the lifter pulls the bar from the ground to arms' length overhead in a continuous sweeping motion, assisted by a springing action of the legs.

From the foregoing description, it may be seen that the Clean and Jerk and Snatch are designed to permit full use of the momentum of the weight, while the Press does not allow this. The Press requires somewhat less muscular coordination or technique than the other two lifts.

In scoring, the best lift made by each method is recorded for the contestant, and the total of the three constitutes his score. The number of trials is regulated in competition and other variables are controlled, thus creating an acceptable experimental situation.

Since the purpose of this investigation was to establish the relationship between body weight and the strength/weight ratio, the score of each competitor was divided by the upper limit of the body weight class in which he competed. The figure thus obtained was multiplied by 100 to yield the percentage of his own body weight lifted by the contestant in the total of the three lifts. For convenience, this percentage is referred to hereafter as the S/W Ratio so that:

$$\text{S/W Ratio} = \frac{\text{Total Lift}}{\text{Body Weight}} \times 100$$

Means and variances of the weight classes were computed for the group made up of the 1952 Olympic weightlifters, and analysis of variance was utilized to determine the cause of variation after the application of Bartlett's test indicated homogeneity of variance.

Results

In Figure I, the S/W Ratio and total lift of both groups have been plotted as ordinates against body weight as abscissa. The S/W ratio versus body weight plot shows a straight component lying between 132 and 198 pounds. For the 1952 Olympic group, this portion of the curve may be satisfactorily described by the formula:

$$Y = y - 1.22\ (X - x)$$

where Y is the predicted S/W ratio, y is the mean S/W Ratio for all classes, X the observed body weight and x the mean body weight for all classes. The slope of this line is negative, demonstrating that a higher S/W Ratio is found in lighter weightlifters. When the total weight is plotted against body weight, a positive slope is obtained, indicating an increase in total strength with, but not proportional to, increased body weight.

A similar graph has been constructed by plotting the world records; however, as might be expected, the lines in this graph have a higher ordinate intercept.

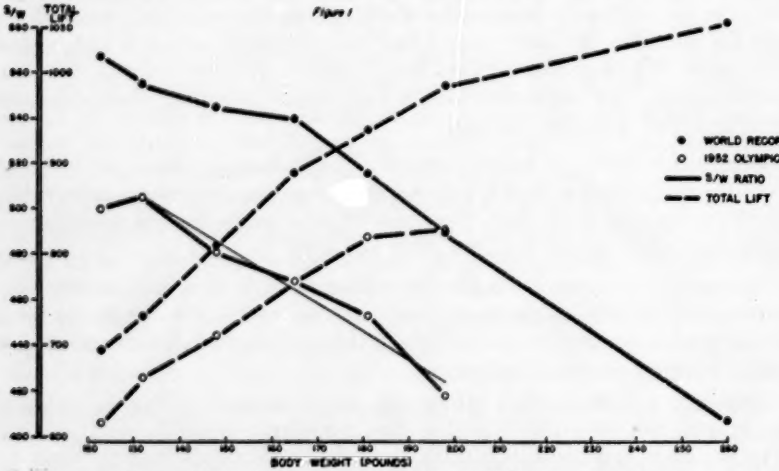

FIGURE I. Plotting of World Record and 1952 Olympic Groups.

Tables 1 and 2 give the scores and S/W ratios of the Olympic group and the world record holders respectively. Analysis of variance (Table 3) shows the major component of variation in the Olympic group to be the between variance. The 123-pound class is not included in this analysis, as the results of the calculations were used to verify the linearity of the regression line which is straight only between classes 132 and 198. However, the omission does not alter the P, which is still less than 0.01, indicating a significant trend of differences between the S/W means of the respective weight classes.

Since, in the group comprised of the Olympic competitors, there was replication within classes, the linearity of the computed regression line could be

TABLE 1
Body Weight and S/W Ratios of the 1952 Olympic Weightlifting Contestants

Weight Class	Mean Total	Number of Contestants	Mean S/W Ratio	Standard Deviation
123	615.0	17	500	35.4
132	666.7	21	505	27.9
148	711.5	21	481	29.7
165	771.9	20	468	33.8
181	820.7	19	453	34.6
198	827.2	16	418	31.4

Regression Equation of Classes 132 - 198 $Y = y - 1.22\ (X\text{-}x)$
$y = 465,\ x - 164.8$

TABLE 2
Body Weight and S/W Ratios of World Champion Weightlifters

Weight Class	Total Score	S/W Ratio
123	699	567
132	732.5	555
148	810	545
165	892.5	540
181	937	516
198	980.5	490
Unlimited (260)	1062.5	407

verified by analysis of variance (Table 4). It was found that when all classes were considered, the data were definitely curvilinear; however, the curve flattened out to a straight line between the 132-pound and the 198-pound classes.

TABLE 3
Analysis of Variance of S/W Ratio of the 1952 Olympic Group Weightlifting Contestants, Classes 132-198

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Total	96	167,724	
Between	4	76,223	19,056
Within	92	91,501	994.6
		$F = 19{,}056/995 = 19.2$ $P = <0.01$	

TABLE 4
Test of Deviation from Linearity

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Between	4	76,223	
Linear regression	1	73,582	
Deviations from linear	3	2,641	880.3
Error	92	91,501	994.6
	$F = 880/995 = 0.885$ (not significant)		

There was a possibility that different weight classes might show differences in the type of lift best performed. Accordingly, the percentage of the total was calculated for each of the three lifts executed by the various weight classes. As may be seen by the data presented in Table 5, there is no apparent evidence of such a trend. Table 5 also shows the percentage of body weight lifted by each group for each of the three lifts. All data in this table are obtained from the Olympic group.

TABLE 5

Percentage of Total and Percentage of Body Weight Lifted by the Olympic Group in Each of the Three Lifts

	Press		Snatch		Clean & Jerk	
Weight Class	% of Total	% of Body Wt.	% of Total	% of Body Wt.	% of Total	% of Body Wt.
123	29.0	145.2	31.0	154.9	40.0	200.1
132	29.5	148.8	31.0	156.4	39.5	199.6
148	29.7	142.6	30.8	148.1	39.5	190.1
165	29.7	138.8	30.7	143.6	39.6	185.3
181	29.7	134.5	30.8	139.7	39.5	179.2
198	29.4	122.8	30.8	128.7	39.7	166.1

Discussion

The negative slope of the regression of S/W Ratio on Body weight demonstrates that in the groups under investigation the lifters in the lighter weight classes are significantly stronger for their size than those in the heavier classes. This superior performance is proportionately distributed throughout the three lifts.

In any attempt to extend the results of a study of this nature to the general population, considerable caution must be exercised. Many of the factors which facilitate analysis of this select group — i.e., minimization of such variables as motivation, body type, conditioning etc.—would actually tend to invalidate carrying over to a larger, more heterogenous group the conclusions reached here. However, it is safe to say that the relationship established herein is at least suggestive that a similar one may generally prevail.

This is especially true in view of the analysis by Loveless (3) of the relationship of the Navy physical fitness test to age, height, and weight. He shows that weight and scores on: (a) the test, (b) push-ups, and (c) pull-ups are related in much the same way as the weight and S/W Ratio of the weightlifters reported on here. In fact, the curves obtained by Loveless are remarkably similar to those shown in Figure I. Owing to the wider range of weights in Loveless' report, the data are seen to be definitely curvilinear. It is suspected by the writer that, if the method used in studying the weightlifters could be extended over a wider range of body weights, there would be a similar drop off from linearity at the extremes of the range.

Implications of this high S/W ratio for small men are readily seen in the light of studies such as Cullumbine's (1) which relates strength, endurance, and speed of movement through analysis of body measurements. If strength

may be thought of as the capacity to exert force, we have a concept that includes the ability to move external objects as well as the ability to change the state of motion of the body itself. In the light of this definition, it will readily be seen that small men in possessing greater strength in proportion to their body weight will tend to exhibit greater speed of movement or agility, and possibly greater endurance. Hence, no table of norms based on average performances for a given weight range will give a true measure of physical fitness.

A question which arises is whether or not the weightlitfers in the lighter weight classes have actually done more work per pound of body weight in achieving higher S/W Ratios. In general, they do not have to move the weight through as great a distance. It is probable, therefore, that the superiority shown would have been lessened had work, rather than total poundage lifted, been divided by body weight.

It is interesting to speculate on the possible causes of this phenomenon, although perhaps premature speculation in view of the scarcity of information as yet available. Karpovich (5) suggests that the bodies of small weightlifters are composed of a higher proportion of muscle tissue than the heavier men. This might be verified through body density measurements. However, other factors may by influential in producing the higher S/W Ratio. For example, favorable leverages in skeletal proportions or quality of muscular tissue as expressed in the proportion of contractile proteins to the structural elements. Undoubtedly, other hypotheses could be advanced; however, at present we must leave the problem to be settled by future investigation.

Summary

Analysis of the relationship of strength/weight to body weight in 121 championship weightlifters shows the contestants in the lighter weight classes to be stronger in proportion to their size than those in the heavier classes. For the five classes 132 to 198 pounds, the relationship is linear with a slope of −1.22. Inclusion of the 123-pound class results in significant deviation from linearity.

The drop-off in the S/W Ratio with increasing body weight may be a factor in the greater agility and endurance usually found in smaller men.

Causal factors are unknown. Proportion of muscle tissue in the body, ratio of contractile to structural proteins in the muscle, or favorable skeletal proportions are suggested as some of the possible causes.

REFERENCES

1. Cullumbine, H., *J. Applied Physiol.* **2**: 155, 1949.
2. Cureton, T. K., *Physical Fitness Appraisal and Guidance*, St. Louis: C. V. Mosby Co. 1947.
3. Loveless, James C., *Research Quarterly* **23**: 347 (1952).
4. Karpovich, P. V., Private Communication.
5. Karpovich, P. V., *Physiology of Muscular Exercise, 4th ed.* Philadelphia: W. B. Saunders Co., 1953 (p. 101).

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Standardization of a Volleyball Knowledge Test for College Men Physical Education Majors[1]

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Abstract

This study presents the procedures used to construct and standardize a valid test to measure volleyball knowledge of male students in college who are majoring in physical education and who have completed their course of instruction in this sport. These procedures include the establishing of curricular validity, item selection, item difficulty, item validity, test reliability, and establishing national norms. The test is reliable and is further designed for machine scoring. Norms for this test are presented in this article.

COLLEGE PHYSICAL EDUCATION teachers have long endeavored to measure, evaluate, and compare the knowledge of their students in physical activities. In the past, measurement and comparison has too often been largely a matter of observation or subjective judgment on the part of the instructor. Since good objective knowledge tests in physical education designed for these purposes often require more time and effort to construct and standardize than typical college instructors can allow, there is a proncunced interest in recent literature concerning the development of satisfactory objective measurement techniques in this field. The literature, however, fails to note any efforts made to construct and standardize physical education knowledge tests for men on the college level, particularly for physical education majors.

Purpose of the Study

The purpose of this study has been to construct and standardize a valid test to measure volleyball knowledge of male students in college who are majoring in physical education and who have completed their course of instruction in this sport.

Procedure

The initial consideration in the construction of this volleyball knowledge test was that of establishing its curricular validity. The technique utilized for this purpose was an analysis of published material followed by the judgment of competent volleyball instructors.

In order to determine the textual material indicative of information that a college physical education major should know concerning volleyball, an in-

[1]This study was made under the direction of Dr. Arthur T. Slater-Hammel, Indiana University, in partial fulfillment of the requirements for the degree of Doctor of Physical Education, 1952.

vestigation was made of the most commonly emphasized phases found in published material dealing in part or completely with volleyball, the four latest issues of the *Official Volleyball Guide*, 14 of the latest issues of the *International Volleyball Review*, and 40 articles written on volleyball. This analysis yielded a list of 11 possible phases of this sport that could well be emphasized in a college course in volleyball for male physical education majors and that could be measured by a knowledge examination. These phases were history, pass, set-up, spike, net recovery, block, service, offensive strategy, defensive strategy, rules, and officiating.

These phases were submitted, in the form of an information blank, to a jury of 19 persons teaching this sport in 19 colleges and universities in the United States which were considered pre-eminent in the undergraduate professional preparation of physical education teachers. Each member of this jury was asked to indicate what he considered the relative importance of each phase to be by assigning each one a percentage value; i.e., if he thought 5 per cent of the class time should be devoted to history, he would indicate a "5" in the percentage column opposite history. In addition, the jurors were asked to indicate additional phases if they thought it necessary. This process was necessary in order to determine what phases of volleyball were actually being taught and what percentage of class time was being devoted to each phase.

Each of the 19 judges returned completed information blanks. Table 1 contains the percentage values assigned by the jurors to each phase and the average percentage values for each phase. All phases received sufficient emphasis to indicate that they should be included in the test. Two additional ones were indicated by two judges, but were not given further consideration as separate phases because they represented only .11 per cent and .21 per cent, respectively, of the total percentages assigned. However, the first of these—sportsmanship—received attention under rules and the second—receiving the spike—was included under defensive strategy.

In determining the reliability of the average rating assigned by the 19 judges to each phase, the correlation was found between the averages of these jurors and the averages to be expected from an infinite number of judges. This correlation was found to be .975, which is sufficiently high to lend confidence that the percentage values assigned to each phase are highly reliable. The formula utilized in determining this reliability coefficient was developed by Peters and Van Voorhis (3).

With the table of specifications as a guide, all available published materials dealing with volleyball, as previously listed, were very carefully analyzed in gathering information for the test. Each playing rule and pertinent statement of information was recorded, exactly as it appeared in the source, on a separate library card. When analyzing each reference it was assigned a code lettering and as each tentative test item was recorded this code was indicated on the index card, together with the page number of the source. As a result of this analysis, 477 tentative statements of information were selected in

TABLE 1

Percentage Values Assigned to Each Phase of Volleyball by 19 Jurors

Judges	Phases												
	History	Pass	Set-up	Spike	Net Recovery	Block	Service	Offensive Strategy	Defensive Strategy	Rules	Officiating	Sportsmanship	Receiving Spike
1	1	10	10	10	5	5	12	25	10	7	5		
2	2	20	10	15	3	10	10	10	10	5	5		
3	5	10	10	10	10	10	10	10	10	5	10		
4	5	5	15	15	5	5	5	15	15	10	5		
5	1	15	10	10	5	10	10	15	15	2	5	2	
6	2	15	15	15	10	10	15	5	5	5	3		
7	2	10	10	10	10	10	10	12	12	12	2		
8	2	13	13	13	8	8	12	10	8	8	5		
9	2	15	10	20	8	10	8	6	6	10	5		
10	5	10	10	10	10	10	10	10	10	7.5	7.5		
11	5	10	10	10	10	10	10	10	10	10	5		
12	2	11.67	11.67	11.67	11.67	11.67	11.67	10	10	5	3		
13	5	9	9	9	5	9	9	15	15	9	6		
14	5	9	9	9	9	9	9	13	13	7.5	7.5		
15	2	10	10	10	10	10	10	12	12	12	2		
16	5	12	10	10	7	10	10	7	7	10	8		4
17	5	5	10	10	10	10	10	10	10	15	5		
18	2	15	15	15	5	5	10	12.5	12.5	6	2		
19	4	11	11	11	4	7	11	13	13	10	5		
Averages	3	11	11	12	8	9	10	12	11	8	5	.11	.21

consideration for test use. After all controversial statements were discarded, the cards were examined and filed according to the phase to which the information thereupon pertained.

Each card was then re-examined to determine to which form of objective-type question the information thereon was best suited. Since the test was to be machine-scored, only true-false and multiple-choice forms of questions were considered. The cards were then arranged into two groups, maintaining order by phase, according to the type of question to which the information was best suited. As a result of this procedure, 265 true-false items and 64 multiple-choice questions were formulated. By a process of logical elimination, the preliminary list of questions was reduced to include 156 true-false items and 50 multiple-choice questions.

There were two factors considered in establishing the length of the test in terms of the number of questions included. First, the amount of time examinees would have to take the test; and second, the number of questions a majority of students could complete within that period of time. Consideration of the time element made it seem practicable that only one class period should be devoted to the test. Since the length of most class periods at the college

level is approximately 50 minutes, the problem reduced itself to the number of questions which could be answered during this period of time. On the basis of evidence presented by Phillips (4, *p. 44*) it was decided that 100 questions could be answered by a majority of students within this time limitation.

To be reasonably sure that the initial tryout of the test would yield 100 valid and reliable test items, it was decided to include the 206 questions in the preliminary testing. Since the examinees would need two class periods to complete this number of questions, the test was randomly divided into two equal parts, Section A and Section B, each having a time limit of 50 minutes.

Each of the two Sections, A and B, of the preliminary test was composed of 103 questions. Part I of each section consisted of true-false items numbered 1 through 78, while Part II was composed of multiple-choice questions numbered 79 through 103. The test, as a whole, agreed approximately with the table of specifications as determined by the jury.

The preliminary mimeographed draft of Section A of the test was administered to a class of 21 physical education majors at Butler University to determine its relative difficulty. On the basis of this preliminary testing, there was ample indication that the test would yield 100 valid questions, with a difficulty range between 7 and 93 per cent and a mean difficulty of approximately 50 per cent.

In duplicating the test, three items were considered: aesthetics, size, and economy. The multilithing type of printing contributed most to these qualities and was utilized. In this process, the test booklets were printed on each side and were reduced in size. For the 19 copies of the examiner's manual, the instructions and directions were mimeographed and stapled into manila folders.

Since the test results were to be machine scored, standard IBM Answer Sheets (Form I.T.S. 1000B 108) were utilized. For this purpose, the multiple-choice answer sheets were selected since the responses for true-false items as well as for multiple-choice questions could be recorded. In indicating answers to true-false questions, the students were given instructions for placing true answers under column one and false answers under column two. To prevent placement of errors, columns three, four, and five were crossed out with perpendicular pencil lines.

These answer sheets also provided regular spaces for each student to record personal information, such as name, school, etc.

A major task in the standardization of physical education testing programs on a national scale is that of selecting representative schools. In an attempt to establish valid and reliable norms for this test, only institutions considered pre-eminent in undergraduate preparation of physical education teachers were selected and utilized. The selection of 17 schools was based upon a doctoral dissertation by Berridge (1). These institutions were selected on the basis of the combined opinion of 66 leading authorities in the field of physical educa-

tion. Two additional institutions were selected to give a better geographical distribution.

The tests were administered only to those male physical education majors in the selected colleges and universities who had completed their course of instruction in volleyball. Class standing was not considered in selection of the examinees.

A package of testing materials was mailed to each of the co-operating schools. Each of these packages included the following materials: 100 standard machine-scoring multiple-choice answer sheets, 100 wooden electrograph lead pencils with erasers, 50 test booklets of Section A, 50 test books of Section B, examiner's manual, return postage, self-addressed gummed label, wrapping paper, binding string, directions for administering, and mailing instructions. Since it was necessary to return the completed answer sheets by first class mail, a large stamped, self-addressed envelope was included in each package for this purpose.

The tests were proctored by one or more members of the physical education faculty of the schools participating in the study. These proctors were designated by the chairman of each physical education department. A careful check was made to ascertain that all test booklets had been collected at the end of the test period.

Seventeen schools returned completed answer sheets ranging from 0 to 53 for Section A and from 0 to 58 for Section B. A total of 488 examinees completed Section A while 510 examinees completed Section B.

The test was scored by means of an IBM Electric Scoring Machine and the results tabulated on the IBM Graphic Item Count Record. Scoring on Part I—true-false questions—was made on the basis of correct responses minus the wrong answers, while Part II—multiple-choice questions—was scored on the basis of number of correct responses.

On the basis of these completed answer sheets a complete evaluation of the test was made. The purpose of this evaluation was to reduce the number of questions to 100 and at the same time retain those items which would yield an optimum validity, reliability, and difficulty and still conform to the table of specifications.

Statistical Analysis

The actual range of scores on Section A for 488 examinees was 86, the mean score was 26.81 when true-false questions were corrected for guessing, and the standard deviation was 13.25.

The range of scores for Section B for 510 examinees was 84, the mean score was 29.05 when true-false questions were corrected for guessing, and the standard deviation was 10.60.

The coefficient of reliability was calculated to be .897 for Section A and .824 for Section B when true-false items were corrected for guessing. The

formula utilized in calculating the section reliabilities was the Kuder-Richardson Formula as adopted by Froelich (2).

The difficulty of each question was determined by computing the percentage of examinees answering each question correctly. The degree of difficulty for questions on Section A ranged from 4.12 per cent to 98.77 per cent. The mean difficulty was 56.58. Those questions which were answered correctly by more than 93 per cent of the students were judged to be too easy and were discarded. Seven were eliminated for this reason. Questions which were answered incorrectly by more than 93 per cent of the examinees were judged to be too difficult and were rejected. Only two questions were eliminated for this reason.

The difficulty for questions on Section B ranged from 2.92 per cent to 97.19 per cent. The mean difficulty was 56.40. On Section B, 9 questions were eliminated because of being too easy. Two questions were eliminated because they were too difficult.

As a check on the validity of the test, the individual test questions were validated. In this procedure, the answer sheets of the upper 27 per cent of the examinees and the answer sheets of the lower 27 per cent of the examinees were separated from the group of completed answer sheets. The proportion of each of the groups answering a test question correctly was then calculated. In determining the significance between these two proportions, a graphical representation was computed, utilizing the formula as developed by Votaw (5).

An elimination was made of those questions in which poor students did as well as, or better than, good students. Such items failed to differentiate abilities.

Those alternate responses to multiple-choice questions which were not selected by at least 3 per cent of the students were replaced or the entire question was rejected from further consideration.

On the basis of preliminary testing of Section A and Section B, a total of 27 questions was rejected from Section A while a total of 35 items was rejected from Section B. Sixty-two undesirable items were thus eliminated. Four items were rejected because of being too difficult, 17 because of being too easy, 2 had no selectivity, 28 had doubtful selectivity, and 11 had adverse selectivity.

On the basis of these data, the questions on the final test were selected. The revised test is composed of 100 valid items with a difficulty range between 7 and 93 per cent and with a mean difficulty of 49.98 per cent. Part I consists of 70 true-false questions numbered 1 through 70. Thirty-three questions are correctly answered with true answers while 37 are correctly answered with false answers. Part II is composed of 30 multiple-choice questions numbered 71 through 100. Six questions are correctly answered with the first alternate response, seven with the second response, six with each of the third and fourth response, and five are correctly answered with the fifth alternate response.

The test also agrees as to topic content in the table of specifications as determined by the jury. Furthermore, the 100 items in the final test are arranged and numbered in order of difficulty, progressing from the easiest to the most difficult. On this test, 51 questions had been selected from Section A and 49 questions had been selected from Section B.

As a result of the preceding analysis, it was concluded that within the limitations imposed by the length of the test and the percentage of questions under each phase an adequate sampling of the material was made on the revised volleyball examination.

Establishing National Norms

The test was then ready for its final administration by which national norms were established.

The process of duplicating and administering the final examination, upon which national norms were determined followed the same general plan that was used in the preliminary testing. The 19 institutions considered pre-eminent in the undergraduate preparation of physical education teachers in the United States were again utilized in administering the final examination.

The tests were administered only to those male physical education majors in the selected colleges and universities who had completed their course of instruction in volleyball. Class standing again received no consideration. Since the final test was not administered until the academic year following the first testing, a different group of examinees was used in establishing norms than was used in the standardization of the test.

The test was scored by means of the IBM Electric Scoring Machine and the results tabulated on the standard IBM Graphic Item Count Record. Scoring on the revised test was made on the basis of number of correct answers.

From 17 of the participating colleges and universities, 723 completed answer sheets for the revised volleyball test were returned. The number of examinees from each school ranged from 12 to 85. The actual range of 723 scores on the revised test was 64, the mean score was 50.12, and the standard deviation was 11.63 when scores were not corrected for guessing on true-false questions.

The coefficient of reliability was calculated to be .823 for the revised test when the true-false items were not corrected for guessing. This coefficient indicates a high reliability for the revised test. The Kuder-Richardson Formula as adapted by Froelich (2) was again used for this calculation.

On the basis of these returns, norms were constructed for male college physical education majors who have completed their instructional period covering volleyball. These norms are given in Table 2 and are presented in terms of T-scores and percentile ranks.

TABLE 2

Norms for Volleyball Knowledge Test for Male College Physical Education Majors Who Have Completed a Course of Instruction in This Sport

Raw score	T-Score	Percentile rank	Raw score	T-Score	Percentile rank
87	82	100	52	52	58
86	81	100	51	51	55
85	80	100	50	50	51
84	79	100	49	49	47
83	78	100	48	48	43
82	77	99	47	47	40
81	77	99	46	46	36
80	76	99	45	46	33
79	75	99	44	45	30
78	74	98	43	44	26
77	73	98	42	43	23
76	72	98	41	42	21
75	71	97	40	41	19
74	71	97	39	40	16
73	70	96	38	40	14
72	69	96	37	39	12
71	68	95	36	38	11
70	67	94	35	37	10
69	66	94	34	36	8
68	65	93	33	35	7
67	65	92	32	34	6
66	64	91	31	34	5
65	63	90	30	33	4
64	62	88	29	32	4
63	61	87	28	31	3
62	60	86	27	30	2
61	59	84	26	29	2
60	58	82	25	28	2
59	58	79	24	28	1
58	57	77	23	27	1
57	56	75	22	26	1
56	55	71	21	25	0
55	54	68	20	24	0
54	53	65	19	23	0
53	52	62	18	22	0

Conclusions

On the basis of this study, the following conclusions are drawn:

1. A volleyball knowledge test has been constructed and standardized.[2]
2. The construction and standardization have been in agreement with the procedures and criteria as recommended by leading authorities in education, psychology, and physical education.

[2]The test is not included with this article because publication would lessen its value and it would then be available for study by students. Any qualified teacher may secure a copy of the test, directions, and scoring key from the author. A charge of 25¢ will be made to cover cost of postage and duplicating.

3. This test has been constructed for use with male college physical education majors who have completed their course of instruction in volleyball.

4. The test is valid, reliable, and objective.

5. The test has a mean difficulty of 49.98 per cent, with a difficulty range between 7 per cent and 93 per cent.

6. The test is composed of 100 objective questions progressing from the easiest to the most difficult.

7. This test is easily administered during one class period of 50 minutes.

8. This test is the first knowledge test that has been designed for machine scoring reported in physical education.

9. National norms have been established in the forms of T-scores and percentile ranks.

REFERENCES

1. Berridge, Harold L., *A Study in the Field of Accreditation of Professional Physical Education.* Unpublished Doctor's thesis, University of Texas, Austin, 1948. 218 pp., p. 77.

2. Froelich, Gustav J., Simple Index of Test Reliability, *Journal of Educational Psychology* **32**: 381-385 (May 1941).

3. Peters, C. C., and W. R. Van Voorhis, *Statistical Procedures and Their Mathematical Bases,* McGraw-Hill Book Co., New York, 1940, p. 165.

4. Phillips, Marjorie, *Standardization of a Badminton Knowledge Test for College Women.* Doctor's thesis, University of Wisconsin, Madison, 1945. 138 pp., p. 44.

5. Votaw, D. F., Graphical Determination of Probable Error in Validation of Test Item, *Journal of Educational Psychology* **24**: 682-686 (Dec. 1933).

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Survey of Swimming Pools in California

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Abstract

This survey reveals significant trends in joint planning, construction, site utilization, and operation of public aquatic facilities by all governing agencies and schools in California. It indicates something of the multiple use and types of pool now being completed. The statistical analysis of these facilities, revealing the large numbers of pools now available, is an index to this phase of capital outlay development in the West. Detailed data on specific facilities are omitted, but information in greater detail can be obtained from the source. Rapid shift to school-centered site utilization is verified and substantiated.

WHEN THE FEDERAL restrictions were lifted several months ago permitting to use of steel and other heretofore critical materials a veritable epidemic of swimming pool construction was launched over the State of California. In many cities and school districts long-delayed plans were culminated and actual facilities were immediately provided. In many other areas, the great need for more adequate swimming facilities began to be translated into careful planning, often properly involving the schools and other governmental agencies.

Purpose of the Study

The Bureau of School Planning and the Bureau of Health Education, Physical Education and Recreation of the California State Department of Education have been in the process of developing a new publication titled *A Guide to Swimming Pool Planning, Construction, and Operation.* It was thought advisable, as a segment of this project, to survey carefully the existing status of swimming pools in the state. By a review of the information uncovered in this survey, other school districts and recreation districts, as well as cities and counties, might be assisted in their efforts to plan more carefully adequate swimming facilities for their areas. Thus, committees in the preplanning stages might be able to select adjacent installations for purposes of visitation and study. It was thought also that certain trends and practices might be indicated.

This study was dedicated to the purpose of giving all possible assistance in the provision of swimming pools for all areas, urban and rural, for instruction, recreation or competition, and in the hope that every boy and girl in the elementary and secondary schools of the state, as well as all post-school youth and adults, may as speedily as possible utilize the aquatic aspect of education and recreation to the maximum.

Scope of the Study

Great detail and care was exercised in obtaining data on all public swimming pools. These included pools owned and operated by elementary school districts, unified school districts, secondary school districts, colleges and universities, cities, counties, recreation districts, and through joint contractual agreement and financing involving two or more of the above. It is believed that the listing of pools for these categories is accurate as of January 1954.

Some attempt was made to estimate the large numbers of swimming pools which are private or semi-private, yet which are available for public use at least part of the time. An attempt was made to estimate rather carefully the large numbers of swimming pools owned and operated by the hotels, resorts, motels, and guest lodges of the state, usually for the primary use of patrons and guests, yet often available for public use on a fee basis. A rough estimate of the number of private or home-owned pools is also included. The construction of home swimming pools has progressed so rapidly in California that it would be difficult, if not impossible, to accurately document the exact number now in use or under construction.

Acknowledgments

The information and data gathered in this survey would never have been possible without the cooperation of staff members of county offices of education in every county of the state. In addition, many recreation directors, city and county officials, physical education supervisors, and other officials filled in the gaps to make the survey accurate and meaningful. Appreciation is hereby expressed for the assistance, coming as it did in the midst of very busy working schedules.

Data and Factual Information

The study discloses a total of 423 swimming pools open to the public or to certain age levels for instruction and recreation in California at the present time. Added to this number are 51 new pools now under construction or in the planning stages. There will be 474 pools operating and serving the needs of children, youth, and adults in this state within a few weeks. It should also be pointed out that a large number of these pools are, in reality, either double or triple-type pools, thus providing facilities for far more participants than the traditional or conventional single rectangular-type pool. In these multiple-type pools, separate pool areas are provided for beginners, for younger children, for diving and water sorts, and for competition.

There are 121 pools owned and operated by cities and communities; 116 pools privately or commercially owned and operated, but open for either limited or unrestricted public use; 92 pools located on high school property; 20 pools owned and operated by counties; 21 pools owned and operated by colleges or universities; 18 pools owned and operated by elementary school districts; 11 pools owned and operated by unified school districts; 16 pools jointly financed and operated by the schools and one or more other governing

agencies; and 8 pools owned and operated by recreation districts. Most of the 51 new pools now under construction are being located on school property, many of them being jointly financed by the schools and other governing bodies.

It should be pointed out that even though various pools are owned and operated primarily by one type of agency, most pools are made available for schools and for community recreation. The presentation of specific data in this survey report indicates clearly the diversity of use for all swimming pools.

In addition to the 474 swimming pools found in this survey, there are large and rapidly multiplying numbers of private swimming pools over the state which provide aquatic participation for a large segment of the people. In January, 1954, this number was estimated at 18,800. In addition to the data supplied for the schools, cities, counties, recreation districts, colleges, and commercially operated facilities, it is estimated there are an additional 50 pools owned and operated by private and parochial schools, clubs, and private agencies. Some of these pools, such as those owned by YMCA's and YWCA's, are available on occasion to segments of the public.

No state is more graciously served by the large number of hotels, motels, resorts, lodges, and inns. A rather careful estimate of 320 swimming pools are maintained by these institutions. Their pools are primarily for the use of guests and visitors, but many of these are also occasionally open to the public; some even being used by contract for the instruction and recreation of elementary school children nearby.

Any estimate of the large numbers of privately owned swimming pools and swimming schools in California must be conditioned by the fact that literally hundreds of private swimming pools are being constructed monthly over the state. An estimate of 18,800 private swimming pools in California might prove to be rather conservative, and certainly such a figure would soon be outdated. It is estimated there are at least 12,200 private pools in Los Angeles County alone. There are at least 2,500 such pools in the remainder of southern California and at least 4,100 such pools in the remainder of the state. The importance of the privately owned and operated swimming schools in this state also cannot be understated. They provide instruction and recreation for thousands of youngsters and adults each season. It is estimated there are some 30 such schools in the San Fernando Valley alone.

It will be seen, after a study and analysis of the data and specific information contained in this report, that California is now served by an estimated total of 19,642 swimming pools. Only the 474 public pools, however, can be counted on to provide opportunity for the needs of most of the state's rapidly exanding population. The fact still remains that too many California communities are still without adequate public swimming facilities, especially in the warmer and more arid areas. The hundreds of miles of ocean, rivers, and lake shoreline do not alleviate the problem. They accentuate the need for more facilities for instruction in the interest of health and safety.

Conclusions and Comments

One of the most encouraging trends indicated by this study is that of joint planning and joint financing and use of swimming pools. There is every evidence that representatives of all community governing bodies are beginning to preplan swimming pools more carefully, studying the total needs of the area for instruction, recreation and competition, and then building accordingly. There is a decreasing tendency to build a pool with a preconceived sum of money without first determining long-term needs.

The trend toward year-round usable pools has been accelerated with use of wind baffles, convertible indoor-outdoor facilities, radiant-heated decks, etc. Pool styles are changing from the traditional rectangular pool. Frequent use of L-shaped pools and the multiple-type of double or triple pools is noticeable. Pool depths are being modified, with more shallow area now provided. Priorities are being more carefully studied with instruction and recreation needs receiving attention prior to the more specialized and limited diving, water sports, and competition.

It is worthy of note that for the 1,631 elementary school districts in California (November 1953) some 127 public swimming pools were used for elementary school instruction and recreation. Two-hundred-fifty pools were used by high school students, a number slightly more than the number of high school districts. This does not mean that every high school in California has access to a swimming pool, at least for adequate instruction and recreation. A definite trend toward the construction of swimming pools for elementary schools is noted, with provision for community use. It should also be noted that many junior colleges in California have access to the high school pool because of the close proximity of both. Where both the high school and junior College are on a single campus, the pool is jointly used.

It is evident that the trend is toward school-site location of pools when jointly financed by other agencies. Los Angeles County is moving toward the objective of a pool at every junior high school. Other sections of the state may favor locations at either elementary schools or high schools. It is suggested that maintenance, sanitation, and more constant use of pools is usually possible on the school site, without in any way retarding the use of the pool for community recreation.

Use for the past few months of the new recreation law AB 1691 (Education Code, Section 6357.2) has enabled school districts to raise additional funds for the operation, maintenance, and leadership for swimming pools, and, in some cases, for the actual capital outlay for the facilities.

There is every reason to believe that swimming pool construction will continue to move forward in California without abatement in the immediate future. Many smaller communities may find the solution to their needs in the trend toward joint sharing of initial cost and continued operation by two or more governing agencies in the area, and may continue to find these facilities beyond their reach when any one agency contemplates the venture.

APPENDIX

Statistical Summary of All California Public Swimming Pools[1]

Owned and Operated by	Year-round Use	Used by Elementary Schools	Used by High Schools	Used for Community Recreation	TOTAL of All Pools
High Schools	60	23	92	64	92
Elementary Schools	6	18	11	15	18
Unified School Districts	6	9	11	10	11
Cities and Communities (3 joint city-county)	12	25	55	121	121
Counties	0	5	8	20	20
Recreation Districts	1	1	2	8	8
Jointly Financed by Schools and/or City-County	8	7	16	16	16
College and University	18	1	2	2	21
Semi-private and Commercially Operated Open to Public	26	11	15	116	116
On Planning Boards or under Construction (24 jointly financed)	38	27	38	51	51
TOTALS	175	127	250	423	474
Estimate of Pools of Private-Parochial Schools and Agencies					50
Estimate of Pools at Hotels, Motels, Resorts					320
Estimate of Private or Home-owned Pools					18,800
	GRAND TOTAL				19,644

[1]The statistical data contained in this study pertinent to the use of public swimming pools in California by elementary and secondary schools was deleted. The Statistical Summary shown here will be of national interest and significance.

(Submitted 3-16-54)

Comparison of Two Methods of Measuring Strength of Selected Muscle Groups in Children

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Abstract

In this study active and breaking strength tests were applied to the knee and elbow flexors and extensors of 43 children seven and ten years of age. Breaking strength tests yielded higher mean scores than active strength tests for both sexes at both age levels. Mean differences favoring breaking strength were significant at or beyond the 5-per-cent level for all muscle groups at seven years of age. At ten years of age, the differences were less reliable.

TWO DISTINCT TECHNIQUES have been used in the objective measurement of static strength of individual muscle groups in the human. Both methods employ a dynamometer for registering the muscular tension or force which is developed.

In the measurement of breaking strength as proposed by Martin (3), the subject resists with maximum effort the pull which the tester exerts through the dynamometer. Bethe (1) refers to this type of strength as passive strength and defines it as "force which the muscle can balance passively." In tests of breaking strength, the muscle works against an increasing resistance by increasing tension up to some limit, or breaking point. The condition under which the muscle develops tension is generally assumed to be isometric, although it tends to be eccentric in that increasing dynamometer tension produces some lengthening of the muscle before muscular resistance is overcome. The force registered by the dynamometer at the instant the resistance of the contracted muscles is overcome is considered as a measure of breaking or resistive strength.

The method more frequently employed measures the tension which a muscle can actively develop against a fixed dynamometer. Since the muscular effort is initiated and is solely dependent upon the subject being tested, this type of strength is referred to as active strength.

The purpose of the present study was twofold:

(1) To compare measures of active and breaking strength of the elbow and knee flexors and extensors in children ages seven and ten; and

(2) To determine if the differences in strength as recorded by the two methods are consistent for both sexes for all muscle groups at the two age levels.

Procedure

Subjects. Forty-three boys and girls from two playgrounds in Madison, Wisconsin, served as subjects. The only selective factor in obtaining the sample was that of securing children whose chronological ages clustered around seven and ten years respectively. The mean age and age range of the subjects are included in Table 1.

TABLE 1

Mean Age and Age Range of Subjects

Number of Subjects	Mean Age (years–months)	Age Range (years–months)
10 girls	7–4	6–7 to 7–11
10 girls	9–9	9–5 to 10–5
10 boys	7–1	6–7 to 7–11
13 boys	9–7	9–1 to 10–7

Strength Measures. Four muscle groups were selected for measurement; namely, the elbow flexors, elbow extensors, knee flexors, and knee extensors. All strength measurements were taken with a standard cable tensiometer. Only the muscle groups on the right side of the body were tested. Tensiometer measurements were converted to strength measurements by means of a calibration chart. The techniques employed for measuring active strength followed the methods described by Clarke (2). The same procedures were used in measuring breaking strength except that the distal end of the tension cable, instead of being fixed, was connected to a leather strap through which the tester applied tension. A goniometer was used in setting the joint angles to agree with those recommended by Clarke. While no evidence has been presented that these angles are the best ones to use with children, it seemed desirable to use Clarke's standards.

All tests were administered by two trained testers. Each subject was given specific directions in respect to the direction of application of power prior to the measurement of each muscle group. One unrecorded practice trial on each test item was given to each subject and was immediately followed by three recorded trials. The basic pattern of administering the tests was as follows: (1) elbow extensors, (2) knee extensors, (3) elbow flexors, (4) knee flexors. The order of administering breaking and active strength measures was altered for successive subjects within each sex at each age level. Likewise, the basic pattern of testing the individual muscle groups was reversed for alternate subjects.

Reliability of Measures. Coefficients of reliability for the breaking and active strength tests are given in Table 2. The reliability coefficients for each measure represent the correlation between the best score and the average of the other two trials. Twenty-five of the 32 coefficients were .90 or higher, with only two falling below .84. The highest of the three strength scores on each test was used in all calculations.

TABLE 2

Coefficients of Reliability of the Strength Tests

Age and Sex	Type of Strength	Elbow Extensor	Elbow Flexor	Knee Extensor	Knee Flexor
7-year girls	Breaking	.99	.94	.98	.94
	Active	.95	.98	.90	.96
7-year boys	Breaking	.89	.95	.73	.96
	Active	.96	.91	.93	.95
10-year girls	Breaking	.93	.98	.84	.89
	Active	.93	.65	.95	.89
10-year boys	Breaking	.99	.95	.88	.97
	Active	.97	.95	.96	.96

Findings

The mean active and mean breaking strength scores for each muscle group by age and sex are shown in Figure I. It will be noted that in all instances the mean breaking strength scores were higher than the corresponding active strength scores. The mean active strength scores of the flexor groups tended to approximate breaking strength more nearly than did those of the extensor muscle groups.

While it was not the primary purpose of this study to make sex comparisons of strength, it may be noted in Figure I that the mean strength of boys

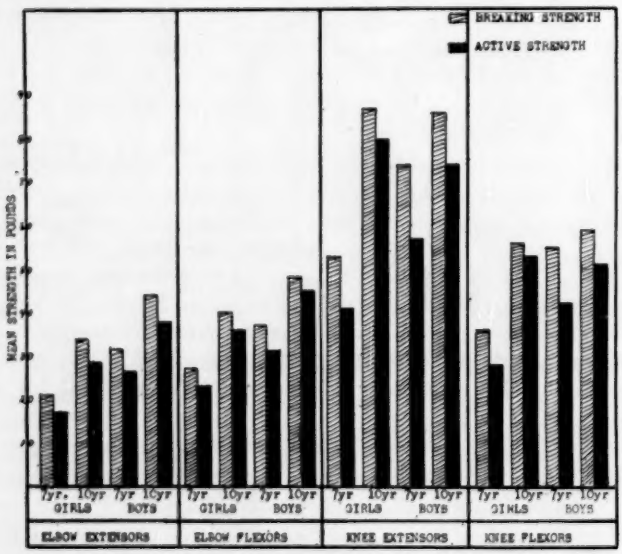

FIGURE I. Mean Breaking and Active Strength Scores of Four Muscle Groups of Seven and Ten-year-Old Boys and Girls

was greater than that of girls for all measures at seven years of age. However, at ten years the mean strength scores of the knee flexor-extensor groups were quite similar for the two sexes. This is perhaps a reflection of the approaching sexual maturity of the girls which is normally accompanied by an acceleration in both physical growth and strength.

The differences between the mean active and mean breaking strength scores are perhaps more clearly evident and more nearly comparable when these differences are presented as an index or a percentage of the respective mean active strength scores. (See Figure II.) The mean breaking strength scores for the different muscle groups ranged from 6 per cent to 31 per cent stronger than the corresponding mean active strength scores. These values are somewhat lower than those reported by Bethe (1), who found that with adults a passive or resistive strength test yields on the average 46 per cent more tension than an active strength test. The data presented graphically in Figure II suggest that, during childhood, differences between breaking and active strength may in part be a function of age, for these differences are relatively greater at seven than at ten years of age.

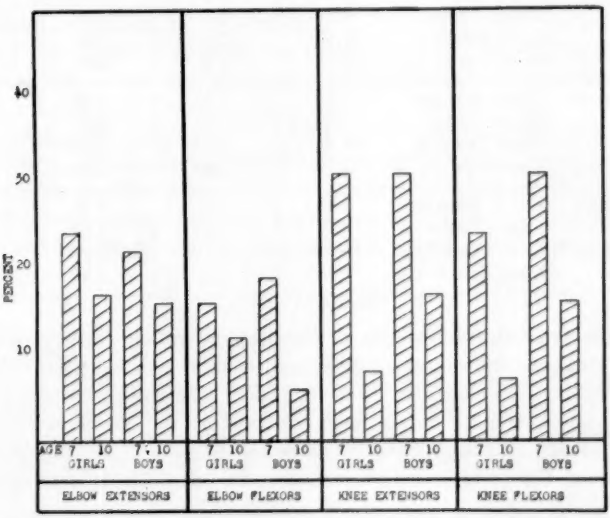

FIGURE II. Percentage Superiority of Mean Breaking Strength Scores Over Mean Active Strength Scores.

Mean differences between breaking and active strength scores for individual muscle groups with corresponding levels of confidence are given in Table 3. It will be noted that all mean differences for the seven-year-olds of both sexes were significant at or beyond the 5 per cent level. With the seven-year-old boys, the mean differences were highly significant (P .01 to .001).

With the older children the obtained differences were not as striking, for in three of the eight tests insignificant differences were obtained and in only half of the tests were these differences significant at or beyond the 2-per-cent level. The high t values which were so apparent for the boys in the younger age group were not so clearly evident with the ten-year-old boys. Exceptions occurred with the latter group in the case of the knee flexors and extensors, with the mean differences being significant at the .02 and .001 levels respectively.

TABLE 3

Mean Differences and Significance of Obtained Differences Between Breaking and Active Strength Scores for Individual Muscle Groups

Age and Sex	Muscle Group	Mean Difference	σ Mean Difference	t Ratio	p
7-year girls	Elbow Extensor	3.99	1.75	2.28	.05
	Elbow Flexor	3.75	1.55	2.41	.05
	Knee Extensor	14.20	2.66	5.34	.001
	Knee Flexor	7.80	3.32	2.35	.05
7-year boys	Elbow Extensor	5.72	1.53	3.74	.01
	Elbow Flexor	6.21	1.87	3.32	.01
	Knee Extensor	17.45	2.37	7.36	.001
	Knee Flexor	14.12	3.18	4.44	.001
10-year girls	Elbow Extensor	5.10	.96	5.31	.001
	Elbow Flexor	4.35	1.99	2.18	.05
	Knee Extensor	6.48	5.42	1.19	.20
	Knee Flexor	3.75	2.88	1.30	.20
10-year boys	Elbow Extensor	5.96	2.41	2.47	.02
	Elbow Flexor	2.89	1.84	1.57	.20
	Knee Extensor	12.99	3.27	3.97	.001
	Knee Flexor	7.54	2.91	2.59	.02

While the data showed higher mean strength values through the use of breaking strength techniques, exceptions to this general trend did occur. These exceptions are shown in Table 4, which indicates the number of cases in which higher strength scores were obtained by the use of active strength measures. Tests of active strength exceeded those of breaking strength in 15 per cent of the cases, when all measures for all subjects were considered.

TABLE 4

Frequency of Occurrence of Superiority of Active Strength Scores

Age and Sex	Number Cases	Elbow Extensors	Elbow Flexors	Knee Extensors	Knee Flexors
7-year girls	10	2	2	1	3
7-year boys	10	1	1	0	0
10-year girls	10	0	3	2	2
10-year boys	13	2	5	1	2

The frequency of superiority of active strength over breaking strength was almost equally divided between the sexes, although with the seven-year-olds higher active strength scores occurred more frequently for the girls than for the boys. It is interesting to note that higher active strength readings occurred twice as frequently from the flexor groups as from the extensors.

Summary and Conclusions

Tests of breaking strength and tests of active strength, applied to the knee and elbow flexors and extensors respectively, were given to 43 boys and girls ages seven and ten. The order of administering the two types of strength measures was systematically alternated to avoid favoring one method over the other.

With the groups studied, breaking strength tests yielded consistently higher mean scores than active strength tests. The mean differences favoring breaking strength were significant at or beyond the 5-per-cent level of confidence for all muscle groups for both sexes at seven years of age. With the ten year olds, the mean differences between the two testing procedures tended to be less reliable, especially for girls on the test involving the flexor and extensor muscles of the knee.

Individual exceptions to the tendency to produce higher readings through the use of the breaking strength technique did occur, for in 15 per cent of the cases higher scores were made with active strength tests, the frequency of occurrence being relatively greater at the older age level.

Although breaking strength tests yield higher average scores, the difficulties encountered in standardizing the technique of measuring breaking strength place some restrictions upon its general use. Furthermore, the activities in which children routinely engage involve most frequently an active type of strength which in itself would recommend the use of active strength measures.

REFERENCES

1. Bethe, Albrecht. Aktive und Passive Kraft Menschlicher Muskeln, *Ergebnisse der Physiologie*, **XXIV** (1925).
2. Clarke, H. Harrison. Improvement of Objective Strength Tests of Muscle Groups by Cable-Tension Methods. *Research Quarterly*, **21**: 339-419 (1950).
3. Martin, E. G., and Robert W. Lovett. A Method of Testing Muscular Strength in Infantile Paralysis. *Journal of the American Medical Association* **65**: 1512-1513 (1915).

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Analysis of Techniques of the Golf Drive

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Abstract

This article presents a study of 12 golf professionals and one amateur. A selection from 2,500 stroboscopic pictures taken by A. G. Spalding was used to analyze the drive of golf professionals Robert T. Jones, Horton Smith, George Dawson, Jimmy Thomson, Harry Cooper, and one amateur Emil Marciniak. A golf drive checklist was devised for use in the study. A comparison was made between the checklist and selected stroboscopic pictures. The movement of the professionals as analyzed from the pictures did not always agree with their answers on the checklist. There seemed to be agreement on the following points: type of grip; position of head and of ball in relation to the body; the power hand and the method of transferring weight; the arc and path of the club.

NO ONE METHOD of hitting the golf drive can be called the correct method because of individual differences. Since the elapsed time of the golf swing is very short, it is reasonable to assume that it is difficult to remember all the elements necessary to hit properly in the golf drive.

Checklist

This study used a detailed checklist based on H. C. Dresser's *Golf Manual for Teaching* (1). It was filled out by 13 golfers. Nine or more agreed as to the following points (*Number of agreements are given in parentheses, for right-hand golfers*):

Stance for Address. Use overlapping grip (11); play the ball off the left heel (12) with the chin back of the ball (11) and the line of the shoulders (12) and hips (11) pointing toward the target.

Backswing. Hands and shoulders start at the same time (11); hands, arms and hips start together (10). The grip of the left hand is not loose (10) and the right elbow is kept close to the side (13). There is a pivot present in the knee action (9) and bending at the knees (10) with bending forward at the hips (9). Hips rotate clockwise (11). The right shoulder is highest (9) and the line of the shoulder points toward the target (9).

At the top of the backswing, the chin is at the same position as at address (12), with the left shoulder directly underneath the chin (12); most of the weight is on the right foot. The club head is firm as wrists are cocked (10) with the club shaft horizontal (10) and the club head not below the left

[1]This is a condensation of the author's unpublished Masters thesis at Springfield College. He is indebted to the A. G. Spalding Company and its technical staff for consultation, for supplying the photographs, and for other aid in the study. Copies of the check list will be furnished by the author on request. Address C. H. Rehling, Golf Chairman, College of Physical Education, Health, and Recreation, University of Florida, Gainesville, Florida.

shoulder (9). The weight is on the right foot (10) while the left hand controls the club.

Start of Downswing. The left hand initiates the downswing (8), the right hand does not (11). The weight shifts to the other foot (10) and the chin position is not changed (10).

Through the Hitting Area. Left arm and club shaft form a straight line to the ball (12); the right arm is straight (11) and allows the club to follow through (10). The weight is on the left leg (11) with the right heel raised off the ground (11), and the shoulders parallel to the line of flight (10).

Following the Impact. The club head continues in the line of flight (12). Most of the weight remains on the left leg (12). The golfer faces the line of flight (11) with the arms fully extended in that direction (12). At the finish of the swing, the right arm is fully extended (12), the wrists are cocked (11) and the right shoulder and hip are directly above the left foot (11).

Comparison of Pictures and Checklist

A selection from 2,500 stroboscopic pictures taken by A. G. Spalding was used to analyze the drive of golf professionals Robert T. Jones, Horton Smith, George Dawson, Jimmy Thomson and Harry Cooper, and amateur Emil Marcinik.

The velocity of the golf ball as measured from these pictures did not differ very much. It averaged 200.26 ft/sec. The highest was achieved by Jones, 229.3 ft/sec; the lowest, by Dawson, was 180.3 ft/sec. The velocity was not related to the size of the golfer.

The movement of the professionals as analyzed from the pictures did not always agree with their answers on the checklist. There seemed to be agreement on the following points: Type of grip; position of head and of ball in relation to the body; the power hand, and the method of transferring the weight; the arc and path of the club. It is not known whether or not they studied their photographs before answering the checklist.

REFERENCES

1. DRESSER, H. O. *Golf Manual for Teaching.* Unpublished thesis. New York University, 1937.

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Reaction Time to Light Stimuli in the Peripheral Visual Field

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Abstract

In an experimental situation involving binocular vision, the reaction time to light stimuli both directly and indirectly perceived was investigated. From the results obtained, it was concluded: (1) reaction time increased as the distance of the response stimulus increased from direct vision; (2) the direction of the response stimulus from direct vision was not a significant variable; and (3) reaction time to response stimuli directly perceived provided an excellent relative index of reaction speed to stimuli indirectly perceived.

ALTHOUGH THERE HAVE been numerous studies of reaction time to visual stimuli reported in physical education research, all of the studies appear to have involved an experimental situation in which the response stimulus was directly fixated. And the problem of reaction time to visual stimuli which are not directly fixated has been largely ignored. That this latter type of a reaction-time situation might be important is suggested in our general recognition of the frequent dependence of successful athletic performance upon making use of the entire field of vision. In numerous athletic activities, an athlete is required to react not only to stimuli directly perceived but to stimuli indirectly perceived, and the speed with which he can react to these situations is generally considered to be a contributing factor to successful performance.

The possibility of finding some relationship between success in various athletic activities and speed of reaction to stimuli not directly perceived is enhanced by the findings of several investigators indicating a difference in reaction time for stimuli directly and indirectly perceived. Poffenberger (1), for example, arranged a reaction-time situation in which the response stimulus fell on the fovea and at 3°, 10°, 30°, and 45° to each side of the fovea. From the results of his investigation, he concluded that, for each eye, a subject's reaction time generally increased as the distance of the stimulus from the fovea increased. He also concluded that the nasal side of the retina gave a faster reaction time than the temporal side. Similar results have been reported by Hall and Kries and by Kästner and Wirth (1, *pp. 41-43*).

Although the three investigations cited leave little doubt as to the effects of stimuli in the peripheral visual field, the problem has by no means been exhausted. For one thing, these investigations have been concerned with a reaction-time situation involving monocular vision, and the status of reaction time to stimuli in the peripheral visual field in a binocular situation is un-

certain. For another thing, no attempt has been made to obtain estimates of the intercorrelations between reaction time measures and location of the response stimulus in the visual field. The study herein reported is concerned with these aspects of the problem.

Method

The method used in this investigation involved a reaction-time situation in which the subject was required to move his fingers off a signal key whenever any one of seven light signals, permanently located around his visual field, came on.

Apparatus. The light signals to which the subject reacted consisted of seven neon glow lamps mounted across the back of a table. These signals were mounted 38 cm. above the top of the table and around an arc with a radius of 58 cm. Using the center light as the 0° position, the other lights were located at 25°, 50°, and 75° along the arc. This arrangement made it possible to present the response signal during any one trial under the following visual conditions:

1. To the center of the visual field.
2. 25 degrees to the left or right of the center of the visual field.
3. 50 degrees to the left or right of the center of the visual field.
4. 75 degrees to the left or right of the center of the visual field.

A head rest, mounted along the front of the table and at the center of the arc described by the light signals, served to support and fix the subject's chin and forehead. This device was adjustable in three dimensions and made it possible to position the subject so that: (1) his head faced the center light, (2) the center of his eye was level with the lights, and (3) his eyes were in line with the diameter of the arc described by the light signals.

The subject's signal key was located in front of the head rest. This key was not secured to the table, and it was possible for the subject to place the key in any position he felt most comfortable for operation.

The electrical circuit for the apparatus described to this point was wired in such a manner that the experimenter could simultaneously throw on anyone of the several light signals and start a standard electric clock. When the subject raised his fingers off the signal key, the electric clock was stopped.

Since the testing laboratory was adjacent to a lecture room, a 300 cycle/sec. tone was used to mask any external disturbances which might act to distract the subject temporarily from his task. This tone was received by the subject through a pair of headphones. The tone also served as a preparatory signal to warn the subject that a light was about to appear.

Subjects and Procedures. Twenty-five male physical education majors served as subjects. Their ages ranged from 20 to 30 years, their median age being 22 years.

The experimental procedures for each subject required two laboratory periods. With but three exceptions, the subjects appeared at the same hour on Monday and Wednesday or Tuesday and Thursday of the same week.

The few exceptions to this schedule were due to memory lapses in which the subjects forgot to appear for their second appointment. In these cases, the subjects completed the two laboratory periods within a five-day interval.

The first laboratory period was used as an orientation and practice period. At the start of this period, the experimenter sat in a chair before the reaction-time table and gave standardized instructions to the subject who stood beside the experimenter. These instructions were accompanied at appropriate places by demonstrations of the position to be taken, the reaction to be made, etc.

Upon completion of this explanation and demonstration, the subject put the headphones on and sat before the table. His head was then adjusted in the headrest as described earlier. Following this, the tone signal was sounded several times to acquaint the subject with the preparatory signal. When it became evident that the subject understood the task required of him, he was then given 100 reaction-time trials. Since this period was used simply as an orientation and practice period, reaction times were not recorded.

During the second laboratory period, the general procedures were reviewed informally, and the subject was given ten warm-up trials. Following this, he was required to complete a total of 175 reactions (25 reactions for each light signal). Both the test trials and the practice trials were completed in a darkened room and under the following conditions:

1. The time interval between initiation of the preparatory tone signal and the appearance of a light signal was varied at random from trial to trial. These intervals were approximately one, two, and three seconds.
2. Once initiated, the tone signal continued until the subject completed his reaction.
3. The sequence of light signals followed a randomized order.
4. The subject was allowed to rest for approximately two minutes after the completion of each group of 25 reactions.

Experimental Design. A double classification design with one observation per subclass was used. In the double classification, rows represented different subjects and columns represented the several light positions. The measures analyzed were the mean reaction times for 25 trials at each light position, and these means were treated as single observations.

Results

The variance analysis of the data on reaction time to light stimuli located in various positions of the visual field is summarized in Table 1. As shown in Table 1, "between subjects" was found to be a significant source of variation.

TABLE 1

Analysis of Variance for Reaction-Time Measures to Light Stimuli in Seven Hortizontal Positions of the Visual Field

Source of Variance	Sum of Squares	df	Mean Square	F	P
Between reaction time measures	492.30	6	82.05	87.29	Above 1%
Between subjects	2158.34	24	89.93	95.67	Above 1%
Residual (error)	135.21	144	0.94		
Total	2785.85	174			

For 24 and 144 degrees of freedom, an F-value of approximately 1.92 is significant at the 1-per-cent level. The obtained F-value of 95.67 was interpreted as being indicative of a postive relationship between reaction times to the several light stimuli, i.e., a subject's reaction time to one light stimulus was related to his reaction time to other light stimuli. In a later paragraph of this report, this relationship will be presented in terms of correlation coefficients.

It is also shown in Table 1 that "between reaction-time measures" was found to be a significant source of variation. For 6 and 144 degrees of freedom, an F-value of approximately 2.93 is significant at the 1-per-cent level. Since the obtained F-value of 87.29 far exceeded this value, it was concluded that there was nonrandom variation in reaction time to the several light signals, i.e., reaction-time measures were not the same.

To determine which light stimuli produced significant differences in reaction time, t-tests were applied to all possible pairs of reaction time means. In performing these tests, the estimated standard error for the difference between pairs of means was obtained by the formula $\sqrt{2s^2/r}$, where s^2 equaled the error mean square and r the number of replicates. For convenience of discussion, the results of this analysis are presented in Tables 2 and 3.

Table 2 summarizes the comparisons of reaction time to light stimuli at equal positions to the left and right of direct vision. For 144 degrees of freedom, a t-value of approximately 1.977 is significant at the 5-per-cent level. Since the obtained t-values all fell below this value, it was concluded that the evidence from this investigation supported the null hypothesis, i.e., the differences between reaction time means at equal positions to the left and right of direct vision were simply random variations.

TABLE 2

Comparisons of Reaction-Time Measures with Light Stimulus at Equal Positions to Right or Left of Direct Vision

Light Position	Mean Reaction Time[1]	Difference	Standard Error Difference	t	P
25° left	27.32				
25° right	27.62	0.30	0.27	1.111	Below 5%
50° left	28.49				
50° right	29.01	0.52	0.27	1.926	Below 5%
75° left	30.96				
75° right	30.93	0.03	0.27	0.111	Below 5%

[1]Reaction time in 100th sec.

Table 3 summarizes the t-values obtained for comparisons of the reaction time to light stimuli in different positions of the visual field. For 144 degrees of freedom, a t-values of approximately 2.611 is significant at the 1-per-cent level. In view of the fact that the t-values for all comparisons were considerably above this value, it was concluded that reaction time increased significantly with the distance of the light stimulus from direct vision.

TABLE 3

Comparisons of Reaction-Time Measures to Light Stimulus in Seven Hortizontal Positions of the Visual Field

Light Position	Mean Reaction Time[1]	Difference	Standard Error Difference	t	P
0°	26.18				
25° left	27.32	1.14[2]	0.27	4.222	Above 1%
25° right	27.62	1.44[3]	0.27	5.333	Above 1%
0°	26.18				
50° left	28.49	2.31	0.27	8.556	Above 1%
50° right	29.01	2.83	0.27	10.481	Above 1%
0°	26.18				
75° left	30.96	4.78	0.27	17.704	Above 1%
75° right	30.93	4.75	0.27	17.592	Above 1%
25° left	27.32				
50° left	28.49	1.17	0.27	4.333	Above 1%
50° right	29.01	1.69	0.27	6.259	Above 1%
25° left	27.32				
75° left	30.96	3.64	0.27	13.481	Above 1%
75° right	30.93	3.61	0.27	13.370	Above 1%
25° right	27.62				
50° left	28.49	0.87	0.27	3.222	Above 1%
50° right	29.01	1.39	0.27	5.148	Above 1%
25° right	27.62				
75° left	30.96	3.34	0.27	12.370	Above 1%
75° right	30.93	3.31	0.27	12.259	Above 1%
50° left	28.49				
75° left	30.96	2.47	0.27	9.148	Above 1%
75° right	30.93	2.44	0.27	9.037	Above 1%
50° right	29.01				
75° left	30.96	1.95	0.27	7.222	Above 1%
75° right	30.93	1.92	0.27	7.111	Above 1%

[1]Reaction time in 100th sec.
[2]Comparisons are between 1st and 2nd member of each group.
[3]Comparisons are between 1st and 3rd member of each group.

Since the differences between reaction time at equal positions to the left and right of direct vision were found to be non-significant, it was felt that the intercorrelations between reaction-time measures could be presented most effectively by ignoring direction and considering only the distance from direct vision. For this analysis a single reaction-time mean was determined for each subject by combining the two sets of measures at each light position, e.g., reaction-time measures for 25° to the left were combined with measures for 25° to the right, etc. The intercorrelations of these measures with each other and with the reaction time mean for direct vision are summarized in Table 4.

As shown in Table 4, the intercorrelations were extremely high, ranging from 0.928 to 0.988. These results were interpreted as indicating that a subject's reaction time to any one light position in the visual field will provide an excellent relative index of his reaction time to light stimuli at other points of the visual field.

TABLE 4

Correlations Between Reaction-Time Measures to Light Stimuli in Several Horizontal Positions of the Visual Field

Location of Stimulus	0°	25°	50°
25°	0.988		
50°	0.946	0.977	
75°	0.963	0.928	0.984

Discussion

The results of this study can be said to confirm the findings of earlier investigations (1) to the effect that reaction-time increases as the distance of the stimulus increases from direct vision. Although the earlier investigations, involving a monocular situation, found that the direction of the stimulus from the fovea influenced reaction time, the results of the present study indicate that direction of the stimulus in a binocular situation was not a significant variable.

While this study was not concerned with the possible relationships between athletic success and reaction time to stimuli not directly perceived, the evidence presented would seem to indicate that such complications in reaction-time studies are not necessary. An athlete's reaction time to stimuli directly perceived will apparently provide an excellent relative index of his reaction speed to stimuli along the peripheral visual field.

Summary

1. An investigation has been made of the speed with which 25 male physical education majors could react to light stimuli located along seven points of the visual field.

2. In an experimental situation involving binocular vision, reaction time was found to increase as the distance of the visual response signal increased from direct vision.

3. The direction of the response stimulus from direct vision was not found to be a significant variable.

4. Reaction time to a stimulus directly perceived will provide an excellent relative index of reaction speed to stimuli indirectly perceived.

REFERENCES

1. Poffenberger, A. T. Reaction Time to Retinal Stimulation with Special Reference to the Time Lost in Conduction Through Nerve Centers. *Arch. Psychol.*, No. 23. 1912.

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Influence of Order of Exercise Bouts Upon Neuromuscular Tremor

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Abstract

The purpose of this study was to illustrate the effect of order of successive exercise bouts upon neuromuscular tremor measures. The procedures involved obtaining tremor measures when knee-bends were completed in a 5-10-15-20 order and a 20-10-15-5 order. It was concluded that: (1) the relationships between tremor measures were markedly different for the two exercise orders and, (2) since tremor measures were conditioned by the order of successive exercise bouts no statement relative to the relationships between tremor measures and the intensity of exercise could be made with any degree of confidence. Some problems of repeated-measurements designs were discussed.

MANY EXPERIMENTAL DESIGNS in physical education research involve procedures whereby successive measurements are taken on the same subjects. Although these repeated-measurements designs do have the advantage of reducing intra-subject differences, they also present some problems.

One problem arises from the fact that subjects often learn something from one measurement to another, and differences between measurements may reflect not only the variations in experimental procedures—with which the experimenter usually is concerned—but they may also reflect the results of practice or learning on the part of subjects.

An interesting example of the disastrous results in ignoring the results of practice or learning effects in repeated measurements is illustrated in two recent reports on the effects of smoking a single cigarette upon recovery from muscular fatigue. In one report (3), all subjects were tested first under smoking conditions and second under non-smoking conditions. Since the experimental results indicated a more successful recovery during the second measurement period, it was concluded that smoking a single cigarette delayed recovery from fatigue.

This conclusion, however, was challenged by Kay and Karpovich (1) on grounds that the difference in recovery might well be due to practice or learning factors rather than the conditions of smoking and non-smoking. These investigators repeated the experiment under procedures in which the order of smoking and non-smoking was randomized. The results of their investigation indicated no significant difference in recovery from muscular fatigue between smoking and non-smoking. However, a comparison of the recovery rates for the two measures revealed consistently higher values for the second period. Since each measurement period involved both smoking and non-smoking conditions, it becomes evident that practice or learning will produce differences in recovery rates.

And in evaluation of the earlier investigation, Kay and Karpovich point out that "because all second tests were non-smoking ones" there is no justification for the experimenter's conclusion regarding the relationship between smoking a single cigarette and recovery from muscular fatigue. In other words, the experimenter's failure to recognize that differences in repeated measurements on subjects may be due simply to practice or learning led to an erroneous conclusion.

A second problem in repeated-measurements designs arises from the fact that subjects often become fatigued during successive measurements. Although the possible effects of fatigue upon measurements might strike one as being so elementary and self-evident that comment becomes unnecessary, numerous experimental reports do appear to ignore this problem. These reports frequently fail to give any indication of provisions for adequate rest intervals between measurements, and they seldom present any evidence of randomizing or counterbalancing in the sequence of measurements. Under such conditions, the interested reader is often left with some reservations regarding the experimenter's conclusions.

A recent report which appears to ignore the effects of fatigue upon successive measurements has been presented by Mitchem and Tuttle (2). In part of this report, the experimenters were concerned with the relationship between neuromuscular tremor magnitude and the strenuousness of exercise. The exercises and the sequence for each kind of exercise involved were:

1. Successive bouts of ten arm curls each with 5 lb., 10 lb., and 15 lb. weights performed at a rate of one curl per second.
2. Successive bouts of 5, 10, 15, and 20 deep knee-bends performed at a rate of one per second.
3. Successive bouts of 720 Kg-m., 1,250 Kg-M., and 1,930 Kg-m. of work in one second on a bicycle ergograph.

The general experimental design for each of the several exercises can be illustrated by the following description of the experimenter's procedures for their arm-curling exercise.

> Each subject came to the laboratory and rested for ten minutes in a supine position on a hospital cot. At the end of the rest period, the subject stood erect and recorded his neuromuscular tremor as previously described. Immediately following the recording of the neuromuscular tremor, the subject performed ten arm curls per bout in successive bouts with 5-, 10-, and 15-lb. weights at the rate of one curl per second. Immediately following each exercise bout, the neuromuscular tremor was again recorded (2, p. 69).

From an analysis of the data obtained under these conditions, it was concluded that the neuromuscular tremor magnitude generally increased with both the intensity and the number of exercises. This, for example, would seem to indicate that exercise with 5-lb., 10-lb., and 15-lb. weights will produce significant differences in tremor magnitude. But the evidence for this is not as clear-cut as the experimenters apparently would have a reader believe.

As far as can be ascertained, no provisions were made for assuring that

the effects of exercise with one weight would be completely dissipated before exercise with another weight was undertaken. Under these conditions, the differences in tremor magnitudes during arm curls may be due to a condition of progressive fatigue, to the particular weights used, or to a possible interaction between progressive fatigue and weights.

About all that can be concluded regarding the relationship between tremor magnitude and exercise with 5-lb., 10-lb., and 15-lb. weights is that the tremor magnitude after exercising with a 10-lb. weight will be greater than the tremor magnitude after exercising with a 5-lb. weight *provided* the former is preceded by exercising with a 5-lb. weight. Also, the tremor magnitude after exercising with a 15-lb. weight will be greater than the tremor magnitudes after exercising with either a 5-lb. or a 10-lb. weight *provided* the former is preceded by exercise bouts with 5-lb. and 10-lb. weights. These conclusions are not necessarily equivalent to the conclusion that 10 arm curls each with 5-lb., 10-lb., and 15-lb. weights will produce significant differences in tremor magnitude. It would appear, however, that the experimenters expect a reader to accept the latter conclusion.

Similar limitations can be said to apply to the significance of differences between tremor magnitudes for knee-bend exercises and work bouts on the bicycle ergograph. In each instance, the experimental procedures seem to involve systematic errors which makes it impossible to arrive at satisfactory conclusions regarding tremor magnitude and the actual experimental variables used. In this respect, the data presented by Mitchem and Tuttle would seem to be misleading.

It is the purpose of the experiment herein reported to demonstrate the effects of progressive fatigue upon the relationship between tremor measures and one of the exercise programs used by Mitchem and Tuttle. The exercises selected were 5, 10, 15, and 20 knee-bends done at a rate of one per second. The experimental procedures involved obtaining tremor measures when knee-bends were completed in a 5-10-15-20 order and in a 20-10-15-5 order, the latter representing random selection from the 24 possible exercise orders.

Method

Tremor Apparatus. A simplified version of the C. H. Stoelting Company apparatus for testing hand steadiness was used to obtain tremor measures. This apparatus consisted of a metal plate containing a 0.147 inch diameter target hole, a stylus with a 0.055 inch diameter metal tip, and a standard electric clock. The metal plate was mounted on a rigid vertical support, and provisions were made for raising or lowering the plate at will. All apparatus components were connected together so that contact of the stylus tip with the edge of the target hole activated the electric clock. With this arrangement, the subject's task was to keep the stylus tip centered in the target hole for 15 seconds wih the arm fully extended and unsupported. The tremor score was determined by the total time the stylus tip contacted the edge of the target hole during the measurement period.

In obtaining tremor measures, the experimenter had the subject grasp the stylus with his right hand and take a position so that his right arm was directly in line with the target hole. The position of the metal plate was then adjusted so that the target hole was in line with the subject's stylus tip when he extended his arm directly forward in a horizontal plane.

Exercise Bouts. Following an initial rest period of ten minutes, the subject was given four successive knee-bend bouts of exercise at a rate of one knee-bend per second. The knee-bends were completed with one foot forward and the hands on the hips. Tremor measures were obtained after rest and after each exercise bout.

With but two exceptions, this program followed that used by Mitchem and Tuttle (2). One exception was that the subject rested in a comfortable chair rather than a hospital cot. The other exception was that an exact interval of two minutes was allowed between the beginning of each exercise bout.

Procedures and Subjects. At the start of each experimental session, standardized instructions were read to the subject explaining the general procedures. These instructions were accompanied by demonstrations for performing knee-bends and for using the tremor apparatus. At the completion of this explanation and demonstration, the subject was given practice on the tremor apparatus until it became evident that he understood the testing procedures.

Forty male physical education majors at Indiana University served as subjects. Their ages ranged from 20 to 37 years, the mean being 25 years. These subjects were divided randomly into two equal groups. One group completed the knee-bend exercise bouts in a 5-10-15-20 order, and the other in a 20-10-15-5 order.

Results and Discussion

The variance analysis of the tremor measures obtained under the experimental conditions of rest-5-10-15-20 knee-bends is summarized in Table 1. As shown in Table 1, "Between tremor measures" was found to be a significant source of variation. For 4 and 76 degrees of freedom, an F-value of approximately 3.56 is significant at the 1-per-cent level. The obtained F-value of 88.18 was interpreted as being indicative of non-random variation in

TABLE 1

Analysis of Variance of Tremor Measures for Subjects Under Experimental Conditions of Rest-5-10-15-20 Deep Knee-Bends

Source of Variance	Sum of Squares	df	Mean Square	F	P
Between tremor measures	172.85	4	43.21	88.18	Above 1%
Between subjects	274.43	19	14.44	29.47	Above 1%
Residual (error)	37.44	76	0.49		
Total	484.72	99			

tremor measures, i.e., tremor measures were not the same for the several experimental conditions.

To determine which experimental conditions resulted in significant differences in tremor measures, t-tests were applied to all possible pairs of measures. The results of this analysis are summarized in Table 2. For 76 degrees of freedom, a t-value of approximately 2.643 is significant at the 1-per-cent level. Since the obtained t-values were all greater than this value, the hypothesis that the differences in tremor measures could be attributed to random variations was therefore rejected. If the possible effects of fatigue are ignored, the progressive increase in tremor measures with the number of knee-bends would seem to support the conclusion that tremor responses "varied directly with the number of knee-bends in each bout of exercise" (2, *p. 71*).

TABLE 2

Comparisons of Tremor Measures Under Experimental Conditions of Rest-5-10-15-20 Deep Knee-Bends

Experimental Conditions	Mean (seconds)	Difference	S. E. Difference[1]	t	P
Rest	5.67				
5 Knee-bends	6.75	1.08	.221	4.89	Above 1%
Rest	5.67				
10 Knee-bends	7.58	1.91	.221	8.64	Above 1%
Rest	5.67				
15 Knee-bends	8.64	2.97	.221	13.44	Above 1%
Rest	5.67				
20 Knee-bends	9.37	3.70	.221	16.74	Above 1%
5 Knee-bends	6.75				
10 Knee-bends	7.58	0.83	.221	3.76	Above 1%
5 Knee-bends	6.75				
15 Knee-bends	8.64	1.89	.221	8.55	Above 1%
5 Knee-bends	6.75				
20 Knee-bends	9.37	2.62	.221	11.86	Above 1%
10 Knee-bends	7.58				
15 Knee-bends	8.64	1.06	.221	4.80	Above 1%
10 Knee-bends	7.58				
20 Knee-bends	9.37	1.79	.221	8.10	Above 1%
15 Knee-bends	8.64				
20 Knee-bends	9.37	0.73	.221	3.30	Above 1%

[1]The standard error of the difference between any two tremor measures was obtained by the formula $\sqrt{2s^2/r}$, where s^2 is the mean square per unit and r the number of replicates.

It is of interest to note that these findings are in substantial agreement with those reported by Mitchem and Tuttle (2). About the only difference in findings is that the earlier report failed to find a significant difference in tremor rate between bouts of 5 and 10 knee-bends. A possible explanation for this difference is that the tremor measures in the Mitchem and Tuttle study were based on a one-second sample of tremor behavior, while the present report is based upon a 15-second sample. Although the two studies

used different measures of tremor, the general agreement in results would seem to justify the conclusion that both studies were sampling substantially the same kind of response.

The variance analysis of the tremor measures obtained under the experimental conditions of Rest-20-10-15-5 knee-bends is summarized in Table 3. As shown in Table 3, "Between tremor measures" was again found to be a significant source of variation. Since an F-value of approximately 2.643 is significant at the 1-per-cent level, the obtained F-value of 60.58 was interpreted as indicating that the differences in tremor measures were not the result of random variations.

TABLE 3

Analysis of Variance of Tremor Measures for Subjects Under Eperimental Conditions of Rest-20-10-15-5 Deep Knee-Bends

Source of Variance	Sum of Squares	df	Mean Square	F	P
Between tremor measures	109.10	4	27.26	60.58	Above 1%
Between subjects	228.04	19	12.00	26.67	Above 1%
Residual (error)	34.06	76	0.45		
Total	371.20	99			

In order to determine which experimental conditions resulted in significant differences in tremor measures, t-tests were computed for all possible pairs of measures. The results of this analysis are summarized in Table 4. At a level of confidence beyond 1 per cent, the t-values presented in Table 4 can be said to show that:

1. The tremor responses after all exercise bouts were greater than the post-rest response.
2. The tremor responses after exercise bouts of 5, 10, and 15 knee-bends were all greater than the response after 20 knee-bends.
3. The tremor responses after exercise bouts of 5, 10, and 15 knee-bends were not markedly different.

These last two conclusions obviously are not in agreement with those from the experimental condition of Rest-5-10-15-20 knee-bends or the Mitchem and Tuttle report (2).

A graphic comparision of the effect of each experimental condition upon tremor measures is presented in Figure I. It will be noted that the relationships between tremor measures and the number of knee-bends for the two experimental conditions are quite dissimilar. Although all differences between tremor measures under experimental condition of Rest-20-10-15-5 knee-bends were not significant, it is of some interest to note that the tremor measures tended to increase with each successive exercise bout. In this respect, the two tremor response trends were somewhat similar.

Since the two experimental conditions varied only in respect to the *order* of performing knee-bend exercises, it becomes evident that tremor responses

TABLE 4

Comparisons of Tremor Measures Under Experimental Conditions of Rest-20-10-15-5 Deep Knee-Bends

Experimental Conditions	Mean (*seconds*)	Difference[1]	Difference S. E.	t	P
Rest	5.44				
5 Knee-bends	8.20	2.76	.212	13.02	Above 1%
Rest	5.44				
10 Knee-bends	8.03	2.59	.212	12.22	Above 1%
Rest	5.44				
15 Knee-bends	8.16	2.72	.212	12.83	Above 1%
Rest	5.44				
20 Knee-bends	7.40	1.96	.212	9.24	Above 1%
5 Knee-bends	8.20				
10 Knee-bends	8.03	0.17	.212	0.80	——— ——
5 Knee-bends	8.20				
15 Knee-bends	8.16	0.04	.212	0.19	——— ——
5 Knee-bends	8.20				
20 Knee-bends	7.40	0.80	.212	3.77	Above 1%
10 Knee-bends	8.03				
15 Knee-bends	8.16	0.13	.212	0.61	——— ——
10 Knee-bends	8.03				
20 Knee-bends	7.40	0.63	.212	2.97	Above 1%
15 Knee-bends	8.16				
20 Knee-bends	7.40	0.76	.212	3.58	Above 1%

[1]The standard error of the difference between any two tremor measures was obtained by the formula $\sqrt{2s^2/r}$, where s^2 is the mean square per unit and r the number of replicates.

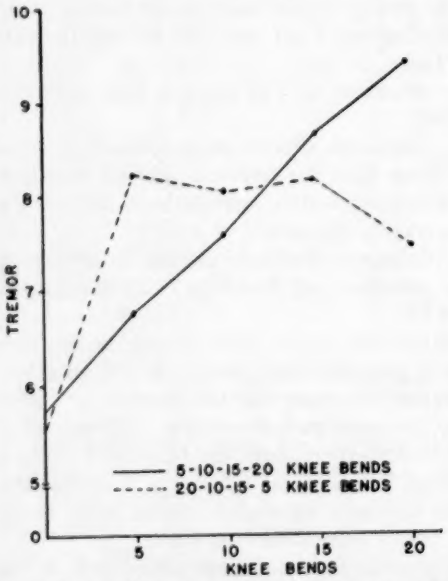

FIGURE I. Comparison of Tremor Measures for Two Orders of Knee-Bend Exercise Bouts.

after any one exercise bout were influenced by previous exercise bouts. In other words, the tremor responses in this experiment were conditioned by the uncontrolled variable of progressive fatigue. Under such conditions, it is impossible to conclude with any degree of confidence that the consciously manipulated experimental variables (5, 10, 15, and 20 knee-bends) resulted in significant differences in tremor response. While it is entirely possible that the tremor responses will vary—at least within limits—"with the number of knee-bends in each bout of exercise," the experimental design does not permit such clear-cut interpretations.

Insofar as the Mitchem and Tuttle experimental procedures appear to have involved the same systematic error, it is suggested that the conclusions regarding the effects of their experimental variables upon tremor magnitudes are not well supported. It is further suggested that the experimental design which appears to have been used in this report is not a very fruitful design for physical education research; the systematic error of progressive fatigue is so hopelessly confounded with the experimental variables that no precise conclusions can be drawn.

Summary and Conclusions

It was the purpose of this study to illustrate the effect of order of successive exercise bouts upon neuromuscular tremor measures. The successive exercise bouts consisted of 5, 10, 15, and 20 deep knee-bends, and tremor measures were based upon the total time a subject's stylus contacted the edge of a target hole during a 15-second test period.

Data were collected upon two randomly assigned groups of 20 subjects each. One group completed the exercise bouts in the order of Rest-5-10-15-20 knee-bends. The other group completed the exercise bouts in a Rest-20-10-15-5 knee-bend order, the latter order being randomly selected from the 24 possible exercise orders. Tremor measures were obtained immediately after an initial period of rest and after each exercise bout. A time interval of 2 minutes was allowed between the beginning of each exercise bout.

From the results of this study, it was concluded that:

1. The relationship between tremor measures was quite different for the two experimental conditions.

2. Since the tremor measures were obviously conditioned by the order of exercise bouts, no statement relative to the relationship between tremor responses and exercise bouts can be made with any degree of confidence.

REFERENCES

1. Kay, Hector W. and Peter V. Karpovich, Effect of Smoking Upon Recuperation from Local Muscular Fatigue. *Research Quarterly* **20**: 250-256, 1949.
2. Mitchem, John C. and W. W. Tuttle, Influence of Exercises, Emotional Stress, and Age on Static Neuromuscular Tremor Magnitude. *Research Quarterly* **25**: 65-74, 1945.
3. Willgoose, Carl E., Tobacco Smoking, Strength, and Muscular Endurance. *Research Quarterly* **18**: 219-225, 1947.

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Relation of Maximum Back and Leg Strength to Back and Leg Strength Endurance

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Abstract

A back and leg dynamometer based on a strain gauge technique, designed for measuring and recording both maximum strength and strength endurance is described. Data collected by use of this back and leg dynamometer showed that (1) individuals with the greater maximum strength have a greater absolute strength endurance index, (2) stronger individuals maintain a smaller proportion of their maximum back and leg strength than those with less initial strength, and (3) the development of strength endurance is not directly proportional to the development of maximum strength.

CONSIDERABLE RESEARCH has been done in an attempt to relate strength to health, physical condition and efficiency, and athletic performance. The limitations of the dynamometers available for these purposes prompted us to design and construct a new type of instrument, based on a strain gauge technique, which not only eliminates the disadvantages of the present type, but also provides for measuring strength endurance as well as maximum strength. The salient characteristics of the new type of dynamometer are (a) measurements are accurate to within ± 2 per cent of a full scale reading, (b) calibration can be done easily, accurately and quickly, (c) strength endurance as well as maximum strength can be measured and recorded, (d) the muscular contractions involved are essentially isometric.

In a previous communication, the grip dynamometer and the techniques employed for measuring maximum grip strength and grip strength endurance have been described (1). It is the purpose of the investigation reported here to show the relation of maximum back and leg strength to back and leg strength endurance, and to describe the dynamometer employed for these measurements.

The Dynamometer

The essential elements of the back and leg dynamometer are shown in cross-section in Figure I. The sensitive element is a Baldwin SR-4 Type U-1 load cell with a rated capacity of 500 pounds. This cell contains a central mem-

[1]The authors wish to acknowledge the helpful advice of Professor Herman Tachau, College of Engineering, State University of Iowa, in the design of the dynamometer.

ber which is strained when a load is applied to the cell. The amount of this strain is measured by resistance wire strain gauges which are connected in a Wheatstone bridge. We chose to use the cell in tension, but it may also be used in compression.

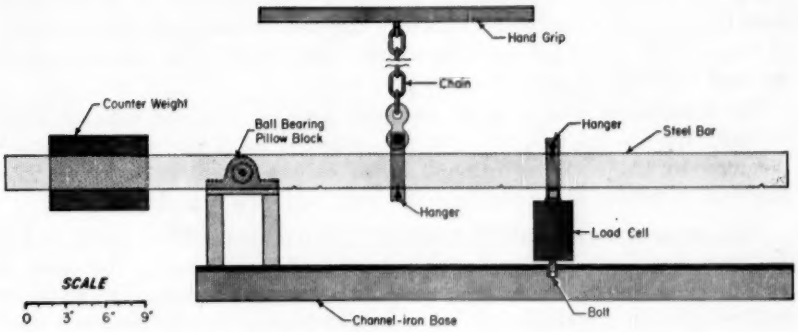

FIGURE I. The Back and Leg Dynamometer.

Forces are applied to the load cell by means of a cold drawn steel bar with a 1-in. x 2½-in. rectangular cross-section. The fulcrum for the bar is a ½-in. round shaft which is supported on each side of the bar by a ball bearing pillow block. Forces are transmitted from the bar to the load cell by means of a hanger containing a knife-edge which rests in a notch in the top of the bar.

The apparatus is mounted on a channel iron base. The load cell is anchored by a bolt which passes through a hole in the base and screws into the bottom of the load cell. The hole in the base is oversize and the bolt is too long to clamp the cell to the base. This type of arrangement prevents excessive side loads on the cell.

A hanger, similar to the one attaching the load cell, but inverted by comparison, is attached to a chain. At the end of the chain is a handle consisting of a piece of ¾-in. pipe. The pipe is attached at a right angle to the chain by means of a hook. The hanger can be placed so that pull is applied at any of the notches along the bottom of the bar. These notches are placed at a distance of 4 in., 6 in., 12 in., 20 in. and 40 in. from the fulcrum. The load cell is 24 in. from the fulcrum. Hence, pulls of 3000, 2000, 1000, 600 and 300 pounds respectively will result in a capacity pull of 500 pounds on the load cell. Thus, the capacity of the dynamometer is 0-3000 pounds.

A lead counter-weight is fastened on the opposite side of the fulcrum to balance the weight of the bar and the load cell so that these weights need not be taken into account in calibrating the apparatus. The weight is adjusted by sliding it back and forth until balance is attained, and then it is clamped in position.

A wooden platform 19 in. x 45 in. (not shown) is mounted on the base, at a height midway between the base and the bar. It is covered with a rubber mat and provides a place for the subject to stand.

Electrical Equipment. Since it was desired to measure strength endurance as well as maximum strength, a recording meter was used. The electrical output of the load cell is too small to activate a recording pen, so an amplifier must be employed. Any amplifier which matches the electrical characteristics of the load cell and of the recording meter is satisfactory. The amplifier which we used was built to order for this purpose.

The Wheatstone bridge in the load cell must be provided with an input voltage. We use 2.5 volt, 60 cycle a.c., supplied by a filament transformer mounted in the amplifier cabinet. Thus only a single cable (four wire shielded) is needed to connect both the input and output of the load cell.

The output of the cell, which is also 60 cycle a.c., is amplified, rectified, and fed to a 5 milliampere d.c. Esterline-Angus recording meter. The meter is operated at a chart speed of 3 in. (four divisions) per minute. The amplifier is provided with a variable gain which is standardized by introducing a fixed resistor in parallel with one leg of the Wheatstone bridge. This unbalances the bridge and simulates the application of a standard force to the load cell. While the bridge is thus unbalanced, the amplifier gain is adjusted so as to produce a standard deflection on the meter. This standard deflection was originally selected so that a full range pull on the load cell would produce a full scale deflection of the recorder.

Calibration. This dynamometer is calibrated as follows: the hanger is placed in the 300-pound notch which is near the end of the bar. A cable is attached to the chain and passed over pulleys supported from the ceiling of the laboratory, in such a way that weights may be hung on the free end of the cable. The pulleys are placed so that the cable rises vertically from the bar. A 300-pound weight is applied to the free end of the cable and the amplifier is adjusted so that this weight produces a full-scale deflection of the recorder. Weights varying from 0 to 300 pounds are then hung on the cable and the respective meter readings noted. The dynamometer is held down during the operation by a brace between the platform of the dynamometer and the ceiling. The meter readings are plotted against the weights, and a line is drawn through the points. The line is straight through most of the range of operation (see Figure II).

The slight curvature found at the bottom and at the top, due to lack of linearity of the amplifier at these extremes, is of no consequence since the instrument is not used at these extremes. If a calibration is made with a series of increasing weights, a very slightly different curve is obtained than with a series of decreasing weights. This mechanical hysteresis is not of sufficient magnitude to introduce appreciable errors into the measurements made with the instrument. The calibration was checked before and after the experiments reported here, and the load cell was found to be stable in this respect.

The gain of the amplifier was checked before each experiment and readjusted when necessary. For greater convenience, a calibration table was constructed from the graph in Figure II.

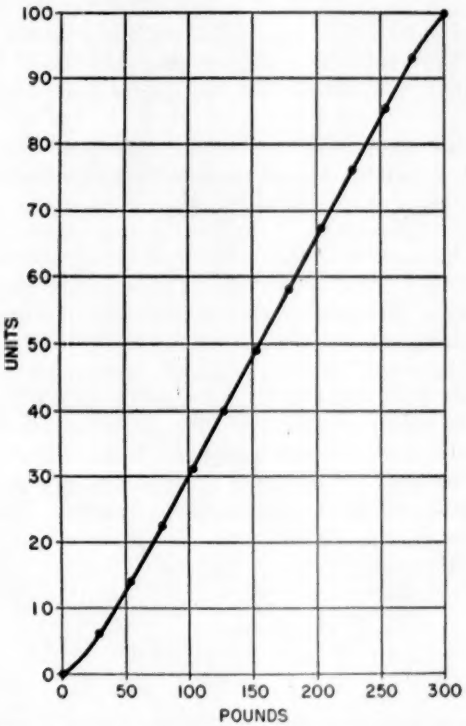

FIGURE II. Calibration Curve for the Back and Leg Dynamometer (0-300 pound range).

The calibrations for the 600, 1000, 2000, and 3000-pound notches are done by multiplying the weights by the ratios of the appropriate lever arms. For example, the calibration of the 1000-pound notch is obtained by multiplying the weights applied to the 300-pound notch by 40/12.

Should one wish to use this dynamometer with a full-scale range of 100 pounds, the gain of the amplifier may be increased three times. Then the notch near the end of the bar will give a range of 0 to 100 pounds. Thus with a suitable harness arrangement, the dynamometer may be adapted to other measurements, such as abdominal muscle strength, where the muscles are less strong than in the legs and back.

In order to protect the load cell from being pulled beyond its maximum capacity, a range is selected which is beyond the limit of strength of the sub-

ject being tested, yet is sufficiently low that the subject can produce a considerable deflection of the meter.

Calculation of Maximum Strength. Maximum strength is defined as the highest point on the strength curve (see Figure III, which is a record of back strength). This value is measured in chart units and converted to pounds by using the calibration table. In Figure III, the highest point on the curve is 66 chart units. When referred to the strength table, this is found to be 402 pounds. The leg strength records look the same and are treated in the same manner.

Leg and Back Strength Endurance Index. Previously (1), we defined the strength endurance index as the average strength for one minute, expressed in pounds. This definition is still useful for grip and leg strength endurance, but in case of back strength endurance, the time interval of one minute presents a problem. Athletes are able to continue back pull for one minute, but for others the time needs to be reduced to 30 seconds. This shorter interval is about as long as the average individual can exert back pull of sufficient amount to register satisfactorily.

If the recording meter made a graph in rectangular co-ordinates, the strength endurance index could be found by measuring, with a planimeter, the area under the strength curve, and dividing by the length of a one-minute time interval on the chart. As seen in Figure III, the ordinates plotted by the Esterline-Angus recorder are measured over the arc of a circle instead of a straight line, thus creating a more complex situation. This requires that allowance be made for this characteristic. The procedure for making the adjustment is as follows:

In the notation of calculus

$$\overline{S} = \frac{1}{T} \int_{t=0}^{t=T} S(t)\ dt \qquad (1)$$

where $\overline{S}$ = average strength, and T = length of time interval. S(t) represents the curve of strength as a function of time. In order to interpret this integral in terms of the area under the curve, refer to Figure IV. The element of area is a parallelogram (Z, Figure IV) whose area is

$$dA = dt \cdot ds \sin \alpha = -R \cos(\beta - \gamma)\ d(\beta - \gamma)dt \qquad (2)$$

For the present, values of ds, S(t), $\overline{S}$, dt, and R will be measured in centimeters; and dA and A will be measured in square centimeters.

Integrating equation 2 gives

$$A = \int_{t=0}^{t=T} S(t) \cdot F(S)\ dt \qquad (3)$$

The curve of F(S) can be calulated from the dimensions of the meter and chart which are used. For the chart used by the authors, F(S) is as shown in Figure V. It is to be noted that the variations in S which are observed in

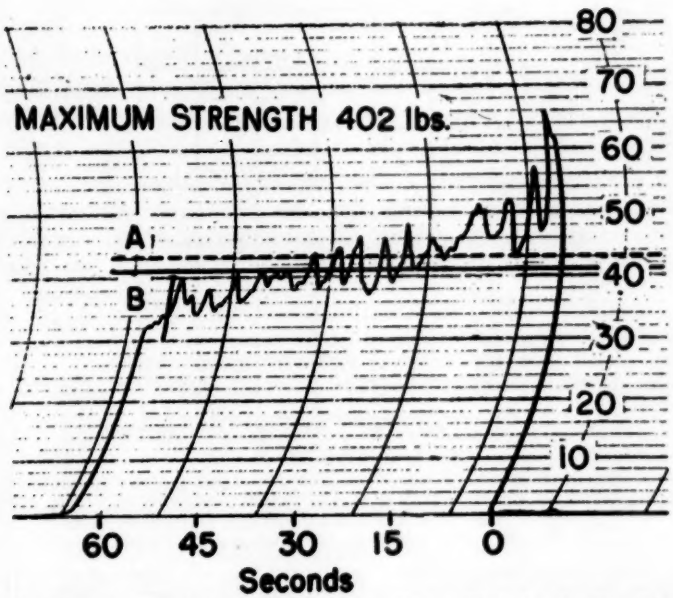

FIGURE III. Strength Record for a Period of One Minute Made by the Esterline-Angus Recorder. (Read from right to left.)

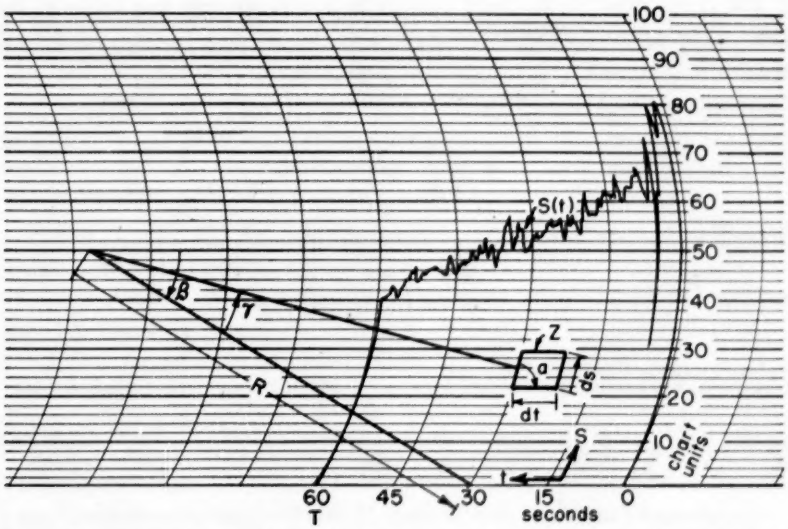

FIGURE IV. Element of the Area Used in Calculating the Relation Between Average Strength and the Area Under the Strength Curve. (Read from right to left.)

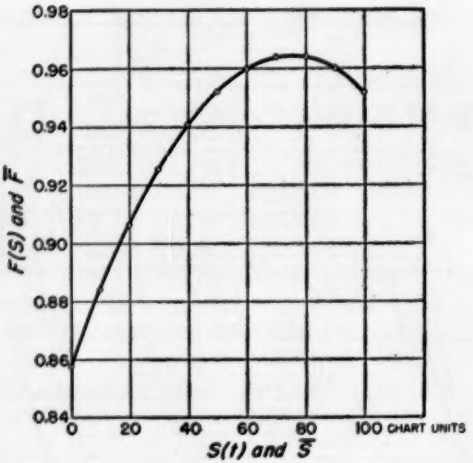

FIGURE V. Factor for Correction (Due to Curvilinear Co-ordinates) of the Area Under the Curve, Used in Calculation of Strength Endurance Index.

any single strength record result in only small percentage changes in F. This makes it possible to evaluate the integral in Formula 3 with satisfactory accuracy by the following approximation.

The mean value of the chart reading $\overline{S}$ is estimated by inspection of the chart. The value of F(S) corresponding to this reading is determined from the graph (Figure V). Let us call this mean value $\overline{F}$. Then $\overline{F}$ is substituted for F(S) in Formula 3:

$$A = \int_{t=0}^{t=T} S(t) \cdot \overline{F} \cdot dt$$

Since $\overline{F}$ is constant

$$\frac{A}{F} = \int_{t=0}^{t=T} S(t)\, dt$$

Substituting in Formula 1 we get

$$\overline{S} = \frac{A}{T\overline{F}} \qquad (4)$$

A is measured in square centimeters. If P is the planimeter reading and p is the factor for conversion of the planimeter reading to square centimeters, then $A = Pp$. Since the strength endurance index is the average strength

for either 30 or 60 seconds, T is the distance the chart travels in either 30 or 60 seconds in the recording meter.

Since it is more convenient to measure $\bar{S}$ in "chart units" than in centimeters, we divide the right-hand member of Formula 4 by the length of one chart unit in centimeters. If the length of this unit is a, then $\bar{S} = Pp/aT\bar{F}$ chart units; or $\bar{S} = (p/aT)\ P/\bar{F}$ chart units. The quantity (p/aT) must be evaluated for each chart, chart recording speed, planimeter, and duration of measurement. In the author's case, $p = 1.00$ sq. cm./planimeter unit, $a = 0.120$ cm., and $T = 7.59$ cm. for a 60-sec. measurement or 3.80 cm. for a 30-sec. measurement. Hence,

(5a)

$$\bar{S} = 1.10\ (P/\bar{F})$$

if the strength endurance index is calulated over a 60-second period or

(5b)

$$\bar{S} = 2.20\ (P/\bar{F})$$

if a 30-second period is used. Formulas 5a and 5b were used for computing $\bar{S}$, and the strength in pounds corresponding to this number of chart units was obtained from the calibration table constructed from Figure II.

In order to estimate the error involved in the approximation for $F(t)$, the average values of a limited number of charts were determined by dividing the interval T into 12 equal smaller intervals. Each of these intervals was short enough to permit an average for that interval to be estimated by inspection. The 12 numbers so obtained were then averaged to obtain $\bar{S}$. A comparison of results showed only one case in which the discrepancy between the value of $\bar{S}$ yielded by this method and that yielded by Formula 5 was greater than one chart unit. Thus, it seems that Formula 5 yields a value of $\bar{S}$ which is correct to ± 1 chart unit. It does not seem worthwhile to require a closer approximation since the meter reading itself is not more nearly correct than ± 1 chart unit.

Calculation of the Strength Endurance Index. The strength endurance index is determined as follows:

1. Estimate the average strength for the duration of the effort by inspection (A, Figure III).
2. Find the value of $(\bar{F})$ from Figure V.
3. Measure the area under the strength curve with a planimeter and record it as planimeter units.
4. Find the average strength, expressed as chart units, by dividing the planimeter reading by $(\bar{F})$, and multiplying this value by 1.10 or 2.20, depending on whether the duration of the effort is 60 or 30 seconds.
5. Refer to the calibration chart to find the number of pounds represented by the value of $\bar{S}$.

For example, the strength endurance for the record presented in Figure III is calculated:

1. Estimated average strength for one minute = 43 chart units. This is indicated by the broken line, A, Figure III.

2. The above value is referred to Figure V to determine $\overline{F}$. In this case $\overline{F} = 0.95$.

3. Area under the strength curve =35.4 planimeter units [P].

4. Substituting into the equation for average strength, $\overline{S} = 1.10\ P/\overline{F} = 41$ chart units.

5. In Figure II, 41 chart units = 131 pounds in the 0-300 pound range. Back strength measurements were made in the 0-600 pound range, hence, 41 chart units = 262 pounds. This is the calculated value of back strength endurance represented by the solid line, B, in Figure III.

Relation of Maximum Strength to Strength Endurance. The conventional methods described by Clarke (2) were employed in applying force to the dynamometer. Care was taken to see that the forces were applied in a vertical line. All subjects included in the experiment were male graduate students in physical education, between the ages of 24 and 46 years. There were 23 subjects participating in the experiment.

1. *Back Strength.* In the experiment dealing with back strength it was found that approximately one-half (10) of the subjects were able to exert measurable force for only a little longer than 30 seconds. It is of interest to inquire whether strength endurance based on a 30-second effort bears the same relation to maximum strength as that based on a 60-second effort. To investigate this point strength endurance indices (S.E.I.'s) were calculated based both on 30 seconds in all cases and on 60 seconds in 13 subjects. A summary of the data are shown in Table 1.

TABLE 1

	Number Subjects	Group Mean (lb.)	S D.	Range (lb.)
Back Strength				
Maximum	23	368	73	196-544
S.E.I. (30 sec.)	23	274	42	184-324
Maximum	13	333	62	196-406
S.E.I. (60 sec.)	13	256	44	172-312
Leg Strength				
Maximum	23	1107	381	654-1950
S.E.I. (30 sec.)	23	893	294	554-1560
S.E.I. (60 sec.)	23	863	259	554-1480

In order to find the relationship between maximum strength and strength endurance the maximum strengths were correlated with the strength edurance indices. The correlations are shown in Table 2. The data show that the correlation of maximum strength and strength endurance based on a 30-sec.

effort is 0.97. When based on a 60-sec. interval the correlation is 0.90. This means that the individual with the greater maximum back strength can maintain a higher level of back strength for the periods of effort investigated, the results being the same regardless of whether the basis of strength endurance is 30 sec. or 60 sec. When the strength endurance index is divided by maximum strength in order to express the former as a percentage of the latter, and when these percentages are correlated with maximum strength, it is seen that the correlations are negative. For a 30-sec. effort, the correlation is —0.81, and for a 60-sec. effort it is —0.48. Thus, the individual with greater back strength cannot maintain as large a percentage of it as the individual with less maximum strength, even though the former's absolute strength endurance is larger than the latter's. This implies that strength endurance does not develop in direct proportion to maximum strength. It may be noted that the results are qualitatively the same whether a 30-sec. effort or a 60-sec. effort is considered.

2. *Leg Strength.* So as to find the relationship of maximum leg strength and leg strength endurance, maximum strengths were correlated with strength endurance indices. Although all subjects were able to perform the strength endurance experiment for 60 seconds, correlations were calculated for both 30 and 60-second intervals. These correlations are shown in Table 2. The data show the same qualitative results as the data on back strength.

It is of interest to note that the maximum strength-strength endurance relationship is the same as that reported with regard to grip strength, in an earlier communication (1).

TABLE 2

Correlations of Maximum Strengths and Strength Endurance Indices

	r	S.D.
Back		
Maximum strength vs. strength endurance (60 sec.)	0.90	0.06
Maximum strength vs. strength endurance (30 sec.)	0.97	0.02
Per cent maximum strength held for 30 sec. vs. maximum strength	—0.81	0.10
Per cent maximum strength held for 60 sec. vs. maximum strength	—0.48	0.21
Leg		
Maximum strength vs. strength endurance (60 sec.)	0.91	0.04
Maximum strength vs. strength endurance (30 sec.)	0.95	0.02
Per cent maximum strength held for 30 sec. vs. maximum strength	—0.26	0.17
Per cent maximum strength held for 60 sec. vs. maximum strength	—0.47	0.16

Summary and Conclusions

A dynamometer designed for measuring and recording maximum back and leg strength and strength endurance is described. In order to show the rela-

tionship between maximum back and leg strength and back and leg strength endurance, data were collected from 23 men between the ages of 24 and 46 years. Also, the percentage of maximum back and leg strength which was maintained from 30-sec. and 60-sec. efforts (strength endurance) was correlated with maximum back and leg strength. The data justify the following conclusions:

1. Individuals with the greater maximum strength have a greater absolute strength endurance index.

2. Stronger individuals can maintain a smaller proportion of their maximum back and leg strength than those with less initial strength.

3. The development of strength endurance is not directly proportional to the development of maximum strength.

4. The results are qualitatively the same whether the endurance is measured over a 30-sec. interval or a 60-sec. interval.

REFERENCES

1. Tuttle, W. W., C. D. Janney and C. W. Thompson. Relation of Maximum Grip Strength to Grip Strength Endurance. *J. Applied Physiol.*, **2**:663-670, 1950.
2. Clarke, H. Harrison. *The Application of Measurement to Health and Physical Education.* Prentice-Hall, Inc., 1946. pp. 142-145.

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A Sociometric Study of Motivated and Non-Motivated Bowling Groups

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Abstract

An analysis of the changes in social adjustment, by means of the Cowell Personal Distance Ballot, of motivated and non-motivated groups in a seven-week bowling class is presented. The results appear to indicate that, while both groups became more socially adjusted as a result of group participation and acquaintance, the motivated group became better adjusted than the non-motivated. A comparison of social adjustment ratings between good and poor bowlers showed the good bowlers to be the better-accepted members of the group.

MAN DOES NOT LIVE in a vacuum, and the social forces that tend to pull him away from that isolation and make him a closer and better adjusted member of the group are important.

What are the factors that contribute to social adjustment? How can we bring people closer together and make them more acceptable to each other? Good human relationships depend upon many things, and when we can have a better understanding of what makes for rejection or acceptance of the individual in his group setting, we can do something about furthering social adjustment.

Sociometry, a study of the interaction of people, affords a method of determining, to some extent, what factors bring people into closer relationships with each other and make them more socially adjusted members of society.

Purpose

The purpose of this study is to compare, by means of personal distance ratings, the social integration and adjustment of motivated and non-motivated college women in a seven weeks' regulation ten pin bowling class.

It is assumed that as the personal distance ratings decrease from one person to another, the more closely integrated is the group, and the more socially adjusted are the people in the group.

Procedure

SUBJECTS

Freshmen college women who had never bowled before were chosen for the study. They were equated as to throwing ability, grip, and arm and shoulder girdle strength. Throwing ability was determined by the sum of 30 underhand softball throws at an archery target 25 feet away. Finger flexor strength was measured on a grip dynamometer. Arm and shoulder girdle

strength was measured for pulling and for pushing strength against a dynamometer with the elbows held in a shoulder-high position and the dynamometer resting lightly against the chest. In a previous study (8), the high-average bowlers had higher mean averages in all of these tests than did the low-average bowlers. While the difference in means was not statistically significant, it did indicate a relationship that may have shown up with larger groups.

CLASS PROCEDURE

All classes were taught by the same instructor and by the same method and procedure, with the exception of the special motivating devices and the addition of throwing practice.

The classes met for 50 minutes twice a week for seven weeks and were composed of 12 students each.

MOTIVATED GROUP

This group consisted of 36 students. Three students were assigned to an alley. Assignments were made on the basis of ability and choice of balls. The students were told they were to stay on the same team throughout the season, and that running team scores would be posted each time so that they could see which team was the winner at the end of seven weeks. It was decided to have the two losing teams treat the two winning teams at the last class period.

Methods of Motivating Group.

1. Running team scores were posted each time. This was for team motivation.

2. All names of persons who scored 100 or over, and all who knocked down an average of 6 pins or more on their first ball, were posted each time on the blackboard. This was to motivate high-score bowlers.

3. Each girl kept a learning curve of her total bowling score, and the average number of pins knocked down on the first ball. This was to motivate, particularly, the low-score bowler. Each student kept her own learning curve on a graph.

NON-MOTIVATED GROUP

This group consisted of 60 students. Each girl was assigned to an alley with two other girls. Each girl kept the same alley and thus the same teammates each time. No mention was made of team competition, and other than the usual commendation of exceptional skill or good progress, no special devices were used to motivate. Two of the five classes were taught without any special aids to improve bowling ability. Three of the classes were urged to practice throwing baseballs at a waist high target, in an effort to improve their bowling score.

SOCIOMETRIC TEST

The Cowell Personal Distance Ballot (6) was given at the beginning of the fourth class period, and again at the beginning of the last class period of the seven-week term. Assignments to alleys were not made before the first balloting; therefore, the students had an opportunity to bowl with other students on different alleys and to become acquainted.

The Cowell Personal Distance Ballot was given as follows:

All the names of the girls in the class were written on the ballot, and the following information was asked:

"If you had full power to treat each player on your team and other players in the class as you feel, just how would you consider her? I would be willing to accept her:

7. Into my family as a sister
6. As a very close "pal" or "chum"
5. As a member of my "gang" or club
4. On my street as a "next door neighbor"
3. Into my class at school
2. Into my school
1. Into my city"

Validity of the Sociometric Test. Kurth and Cowell (6) in the validation of the Cowell Personal Distance Ballot as a social adjustment index found a correlation of .844 with the students' "who's who in my group" rating and .900 with the Dean's Guidance Office Rating.

Treatment of Data

GROUP SOCIAL ACCEPTANCE SCORE

This was determined by averaging the ratings each girl checked for other members of her class. These averages were added for the entire group considered and divided by the number of people balloting.

SOCIAL ACCEPTANCE RATINGS OF TEAMMATES

These were determined by averaging the ratings made by each girl of her team or alley mates, and dividing by the number of people rating.

DIFFERENCES IN SOCIAL ACCEPTANCE RATINGS

Entire Group. The group social acceptance score as determined by each girl toward her group was compared for differences in means from the beginning and the end of the season.[1]

Teammates. Each girl was compared for her change in rating toward each of her team or alley mates by a comparison of the mean difference.

$$t = \frac{\text{M of Diff.}}{\sqrt{\frac{\Sigma (d - \bar{d})^2}{N - 1} \left(\frac{1}{N}\right)}}$$

SOCIAL ACCEPTANCE SCORE OF HIGH- AND LOW-SKILLED BOWLERS

All students who had a season's average of 95 and over were given a rating which was the average of what other members of the class thought of them. Similarly, the ratings of all students who had a seasonal average of 80 and below were obtained. Classification as to high- and low-average bowlers was purely an arbitrary one. The majority of high-skilled bowlers had an average of over 100. All students were advised not to bowl outside of class. Co-operation in regard to this was excellent.

Results and Their Interpretations

SOCIAL INTEGRATION AS A RESULT OF ACQUAINTANCE AND GROUP PARTICIPATION

Entire Group. An analysis of Table 1 shows that, as a result of acquaintance, both the motivated and non-motivated groups became more closely knit. This difference in social integration is shown to be significant at the .1 per cent level of confidence.

From Table 2, it is apparent that, at the end of seven weeks, the motivated group was a more socially integrated group; e.g., the students in the group were more socially acceptable to one another. The mean was 4.69, which would make the average acceptance of the group more toward a "member of my 'gang' or club," whereas the mean of 4.37 of the non-motivated group would make the social acceptance index nearer the "next door neighbor" class. When the means of the two groups were compared, this difference was shown to be a statistically significant one.

TABLE 1

Means of the Differences in Social Acceptance Ratings Before and After Seven Weeks of Bowling

Analysis	Motivated Group	Non-Motivated Group
M	.664	.545
SD	.719	.736
Range	−.4 to +2.1	−.5 to +2.2
N	36	55
t	5.47	5.44
Level of Significance	.1%	.1%
t of Difference in Means of Differences	.75	

TABLE 2

Means of the Two Groups' Social Acceptance Score at the End of Seven Weeks of Bowling

Analysis	Motivated Group	Non-Motivated Group
M	4.69	4.37
SD	.646	.715
Range	3.1 to 6.1	2.9 to 6.0
N	36	55
t	2.14	
Level of Significance	5%	

At the first balloting the means of the motivated and non-motivated groups were 4.026 and 3.820 respectively, with a t of .41. Therefore both means were the same at the start of the experiment.

Teammates. Both groups had a higher mean acceptance score toward their teammates then toward the entire group, which perhaps indicates the closer integration of small groups (Table 3).

Whereas the members of both groups became more acceptable to one another as a result of seven weeks' acquaintance and participation, the non-motivated group was less extreme in the change of range of feeling toward each teammate (Table 4).

TABLE 3

Social Acceptance Rating of Teammates at the End of Seven Weeks of Bowling

Analysis	Motivated Group	Non-Motivated Group
M	5.10	4.77
SD	1.12	1.20
Range	2.5 to 7	1 to 7
N	36	55
t	1.25	

TABLE 4

Means of Differences in Social Acceptance Ratings of Individual Teammates Before and After Seven Weeks of Bowling

Analysis	Motivated Group	Non-Motivated Group
M	.652	.903
SD	1.521	1.357
Range	−5 to +5	−4 to +4
N	69	113
t	3.53	7.04
Level of Significance	.1%	.1%
t of Means of Difference	1.15	

SOCIAL ACCEPTANCE ON THE BASIS OF SKILL

Of the 96 bowlers, 25 were classified as high-average bowlers (average score of 95 and better), and 33 were classified as low-average bowlers (average score of 80 and below). Of the motivated group, 13 (36%) were high-average bowlers, and 10 (27%) low-average bowlers. Of the non-motivated group, 12 (20%) were in the high-average group, and 23 (38%) were in the low-average group.

That the high-average bowler is more acceptable to his group than the low-average bowler is evident from Tables 5 and 6. The acceptance of the high-average bowler was nearer the "member of the 'gang' class," while the low-average bowler was accepted near the "next door neighbor" category. This difference in acceptance was significant.

TABLE 5

Social Acceptance Ratings of Motivated and Non-Motivated Groups Towards High- and Low-Average Bowlers at the End of Seven Weeks

Analysis	High-Average Bowlers	Low-Average Bowlers
M	4.64	4.28
SD	.539	.584
Range	3.7 to 5.7	3.1 to 5.1
N	25	33
t	2.41	
Level of Significance	2%	

TABLE 6

Comparison of High- and Low-Average Bowlers in Motivated and Non-Motivated Groups

Analysis	Motivated Group		Non-Motivated Group	
	High-Avg.	Low-Avg.	High-Avg.	Low-Avg.
M	4.72	4.40	4.56	4.22
SD	.57	.56	.49	.58
Range	3.7 to 5.7	3.4 to 5.1	3.7 to 5.4	3.1 to 5.1
N	13	10	12	23
t	1.27		1.69	

Conclusions

The results of this study appear to indicate the following conclusions.

1. Motivated groups are more closely knit than non-motivated.
2. Groups become more closely integrated socially as a result of acquaintance and group participation.
3. The better performer is a better accepted member of the group than the poor performer.

REFERENCES

1. Biddulph, Lowell G., Athletic Achievement and the Personal and Social Adjustment of High School Boys, *Research Quarterly* **25**: 1-7, 1954.
2. Breck, Sabina June, A Sociometric Measurement of Status in Physical Education Classes, *Research Quarterly* **21**: 75-82, 1950.
3. Cowell, Charles C., A Suggested Index of Social Adjustment in the High School, *Educational Research Bulletin* **17**: 10-19, 1938.
4. Frost, Ardith Bernice. *The Relationship Between a Volley Ball Test and Students' Choices of Teammates and Friends.* Unpublished Master's thesis, University of California at Los Angeles, 1947.
5. Fulton, Ruth E., Relationship Between Teammate Status and Measure of Skill in Volleyball, *Research Quarterly* **21**: 274-276, 1950.
6. Kurth, Frank E., and Charles C. Cowell. Validating an Index of Social Adjustment for High School Boys, *Paper Presented at the Midwest AAHPER District Convention*, Indianapolis, Indiana, 1954.
7. Skubic, Elvera, A Study in Acquaintanceship and Social Status in Physical Education classes, *Research Quarterly*, **20**: 80-87, 1949.
8. Trapp, William G. *A Study of Social Integration in a Football Squad.* Unpublished Master's thesis, Purdue University, 1951.
9. Walters, C. Etta, A Perceptual Approach to the Teaching of Bowling, *Perceptual and Motor Skills Research Exchange* **4**: 75-79, 1952.

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Construction of Equivalent Forms of an Attitude Scale

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Abstract

The criteria generally accepted for constructing attitude scales were followed in the construction of each of these two scales of attitude toward physical education. Standards of equivalence were also set up and followed in "equating" the two forms. The forms are proposed for use in appraising attitude changes resulting from brief experiences such as listening to a talk on physical education, watching a demonstration, viewing a film, or taking part in some activity. The two thirty-statement forms are given at the end of the article.

THE PURPOSE of this study was to attempt to develop two equivalent forms of a physical education attitude scale. The construction of a single scale, together with the techniques and procedures involved in the construction, has been described elsewhere (4). The same techniques and procedures were used in the present study and will be described only where believed necessary for a better understanding of what has been attempted here. A detailed description will be given, however, of the manner in which the two new forms were "equated." The two forms contain 30 statements each and will be referred to as Form A and Form B (see Appendix, p. 117).

It is believed that equivalent forms of an attitude scale can serve a useful purpose in much the same manner as equivalent forms in other areas of testing. We might be interested in making an objective assessment of shifts of attitude, if any, as a result of certain short-term or long-term planned experiences to which people might be subjected. For example, we might be interested in knowing whether or not attitudes change, and how much, as a result of a reading assignment, seeing a film, listening to a talk, watching some activity, or participating in some activity. We should be interested in knowing what happened to attitudes as a result of participation in a semester of physical education having certain content or having certain methods of instruction employed.

We might consider the point that, because of the nature of attitudes, we do not need equivalent forms for their appraisal. That is, we might be interested in knowing if there is any change in the subject's response to the *same* statement in *before* and *after* situations. However, in order to rule out any influence, through suggestion, of the first response upon a subsequent response, particularly in short-term studies, the use of an equivalent, but not identical, set of statements would be indicated. No studies have been found which involved the construction or use of equivalent forms of attitude scales.

Procedure

Statements making up the two forms were taken from the list of 120 statements used in the study mentioned above (4). Four principles or standards were set up for making the forms equivalent: (a) statements are to be matched on the basis of discrimination indices; (b) statements are to be matched on the basis of favorableness indices; (c) statements which seem to be quite similar are to be placed in different forms; and (d) statements of the two forms are to tap approximately the same expected objectives or outcomes of physical education. The use of these four standards will be discussed in the following four paragraphs.

With two exceptions, only those statements were used which were in the upper 50 per cent when ranked on the basis of discriminative power as calculated by they use of Flanagan's table (3, *p. 348*). The median discrimination index of the 120 statements was 0.58. The two statements used which were below this median have indices of 0.57 and 0.55. The sum of the indices for Form A is 20.08 with a range of 0.59-0.81 and a median of 0.68. The sum of the indices for Form B is 20.07 with a range of 0.55-0.82 and a median of 0.65.

A statement "favorableness index" is similar to the "difficulty index" of an item in an academic test. The degree of difficulty of an academic test item is an important characteristic of the item. Items which are extremely easy or extremely difficult are generally to be avoided because they do not discriminate well between students taking the test. Similarly, an attitude statement which is so worded that nearly everyone agrees with it (or disagrees with it) is not a good statement to use in the scale. The favorableness index of an attitude statement as used in this study is the ratio of the total number of subjects agreeing with the statement (both moderately and strongly) to the total number responding to the statement, and is expressed as a decimal fraction. For example, if a total of 81 out of 100 subjects agree with a statement, the favorableness index of the statement is 0.81. The sum of these indices for Form A is 21.61 with a range of 0.42-0.88 and a median of 0.76. The sum of the indices for Form B is 21.26 with a range of 0.37-0.85 and a median of 0.72.

When the wording of two statements seemed to indicate that they were tapping approximately the same specific attitudes, they were placed in different forms. When similarity between certain pairs was suspected, tetrachoric correlation coefficients were computed from the Chesire-Saffir-Thurston computing diagrams (1). A coefficient of 0.70 was arbitrarily selected as the criterion of similarity. Statements having this correlation, or higher, were placed in different forms.

In setting up the original list of 120 statements, attention was directed to the inclusion of statements which tapped attitude toward each of eight generally accepted outcomes to be expected from physical education. The statements were later classified into only four categories. These categories were

designated as "physiological-physical," "mental-emotional," "social," and "general." A statement which seemed to be related more to the physiological or physical outcomes or objectives was placed under "physiological-physical," etc. Statements which did not seem to be related to one of the first three categories were placed under "general." The 30 statements of Form A are divided among the four categories as follows: physiological-physical, 6; mental-emotional, 7; social, 8; and general, 9. Form B is divided as follows: physiological-physical, 5; mental-emotional, 7; social, 10; and general, 8.

The two forms were administered to 100 male university Freshmen together with a short questionnaire consisting of three questions and a graphic self-rating scale (4) on attitude toward physical education. The purpose of the questionnaire was to secure information which might support an affirmative answer to the question: Do the scales measure what they are supposed to measure? These questions and the self-rating do not, of course, serve as external criteria. Correlations between scale scores and responses to questionnaire items would merely indicate the consistency with which certain measures of attitude were "hanging together."

The three questions used were selected because they involved likes, dislikes, and experiences which the writer believed would be significantly related to attitude toward physical education. The questions and possible responses were as follows: NO. 1, *How important do you consider physical activity (sports or athletics) at the present time as a part of your personal recreation program?* (a) very important (b) quite a bit; (c) some; (d) a little; (e) none at all. NO. 2, *To what extent do you* LIKE TO PARTICIPATE *in sports activities?* (a) very much; (b) quite a bit; (c) some; (d) a little; (e) not at all. NO. 3, *If you took physical education in high school as an activity subject during school hours, did you like it?* (a) liked it very much; (b) liked it a little; (c) difficult to say; (d) disliked it somewhat; (e) disliked it very much. Answers to these three questions were scored on a 5-4-3-2-1 basis from (a) to (e). Responses to the attitude statements were also scored on a 5-4-3-2-1 basis with a "5" being assigned to the selected response which indicated the most favorable attitude toward physical education. The self-rating was scored on a nine-point scale.

Analysis of Data

The mean of the scores on Form A was 114.59, with SD of 17.24. The Form B mean was 114.45 with SD of 17.67. The reliability of Form A, calculated by the use of the split-halves technique and the Spearman-Brown formula, was 0.94. The reliability of Form B was 0.96. The product-moment correlation between scores on the two forms was 0.96.

Product-moment correlation coefficients were computed to determine the relationships between each scale form and two of the questionnaire items—question No. 1 and the self-rating. The correlations were as follows: Form A and question, $r = 0.74$; Form B and question, $r = 0.71$; Form A and self-rating, $r = 0.80$; Form B and self-rating, $r = 0.78$.

In another type of analysis an investigation was made of the extent to which scores made on each form tended to differentiate between groups which had undergone different experiences or which held to different feelings or practices as indicated by responses to the questionnaire items. For each item, the subjects were divided into two groups on the basis of selected responses. Mean scores and variances for groups were computed. Tests of significance of difference were applied to differences between means and to differences between variances. These data are given in Table 1.

The F test of significance of difference between variances (2) was applied to the variances of paired groups first because the use of the t-test is not appropriate where variances are not approximately equal. The per-cent-level of significance of variance differences for paired groups is given in the F column. Variance differences for the last two pairs of the table were not significant at the 5 per cent level; t's were computed for all pairs regardless of variance differences and were all found to be significant at the 1 per cent level. Pairs of N's do not total 100 because of certain incomplete papers. When N's differ as greatly as they do in the first two pairs, a better test than t would be to test the probability of getting a sample of size of the smaller N from the larger sample. By testing the difference between means in this manner we still get a 1-per-cent level of significance.

TABLE 1

Comparisons of Variances and Mean Scores of Paired Groups: Groups Defined on Basis of Responses to Questionnaire Items

	N	M	SD	F	t
Self-Ratings, Form A					
For	84	119.00	13.49	2.31	
Not for	8	81.37	19.15	5%	
Self-Ratings, Form B					
For	84	118.75	13.12	2.20	
Not for	8	79.63	18.17	5%	
Question 1, Form A					
Important	68	121.78	12.24	2.01	
Not important	31	98.68	17.36	1%	
Question 1, Form B					
Important	68	121.16	12.71	1.82	
Not important	31	99.80	17.14	5%	
Question 2, Form A					
Like much	70	120.10	13.47	2.15	
Like little or none	28	101.25	19.75	1%	
Question 2, Form B					
Like much	70	119.40	13.74	1.92	
Like little or none	28	102.25	18.62	5%	
Question 3, Form A					
Like	59	119.83	15.31		3.84
Dislike	25	105.00	17.48		1%
Question 3, Form B					
Like	59	118.88	14.67		3.41
Dislike	25	106.12	17.45		1%

Summary

The purpose of this study has been to attempt the construction of two forms of a physical education attitude scale which are equivalent in the usual educational sense. The forms have been shown to be statistically reliable. Scores on the forms have been shown to correlate highly with other measures of attitude and to differentiate at high levels of confidence between certain groups of subjects. Standards of equivalence have been proposed and followed in the construction. A very high correlation exists between scores on the two forms. On the basis of this evidence we believe these two forms may be employed wherever the use of equivalent forms is desired. They should be particularly useful in determining attitude changes resulting from such brief experiences as listening to a talk, watching a demonstration, viewing a film, or taking part in some activity.

APPENDIX

Physical Education Attitude Scales

For directions for responding to statements see previous study (4).

FORM A

1. If for any reason a few subjects have to be dropped from the school program, physical education should be one of the subjects dropped.
2. Physical education activities provide no opportunities for learning to control the emotions.
3. Physical education is one of the more important subjects in helping to establish and maintain desirable social standards.
4. Vigorous physical activity works off harmful emotional tensions.
5. I would take physical education only if it were required.
6. Participation in physical education makes no contribution to the development of poise.
7. Because physical skills loom large in importance in youth, it is essential that a person be helped to acquire and improve such skills.
8. Calisthenics taken regularly are good for one's general health.
9. Skill in active games or sports is not necessary for leading the fullest kind of life.
10. Physical education does more harm physically than it does good.
11. Associating with others in some physical education activity is fun.
12. Physical education classes provide situations for the formation of attitudes which will make one a better citizen.
13. Physical education situations are among the poorest for making friends.
14. There is not enough value coming from physical education to justify the time consumed.
15. Physical education skills make worthwhile contributions to the enrichment of living.
16. People get all the physical exercise they need in just taking care of their daily work.
17. All who are physically able will profit from an hour of physical education each day.
18. Physical education makes a valuable contribution toward building up an adequate reserve of strength and endurance for everyday living.

19. Physical education tears down sociability by encouraging people to attempt to surpass each other in many of the activities.
20. Participation in physical education activities makes for a more wholesome outlook on life.
21. Physical education adds nothing to the improvement of social behavior.
22. Physical education class activities will help to relieve and relax physical tensions.
23. Participation in physical education activities helps a person to maintain a healthful emotional life.
24. Physical education is one of the more important subjects in the school program.
25. There is little value in physical education as far as physical well-being is concerned.
26. Physical education should be included in the program of every school.
27. Skills learned in a physical education class do not benefit a person.
28. Physical education provides situations for developing desirable character qualities.
29. Physical education makes for more enjoyable living.
30. Physical education has no place in modern education.

FORM B

1. Associations in physical education activities give people a better understanding of each other.
2. Engaging in vigorous physical activity gets one interested in practicing good health habits.
3. The time spent in getting ready for and engaging in a physical education class could be more profitably spent in other ways.
4. A person's body usually has all the strength it needs wtihout participation in physical education activities.
5. Participation in physical education activities tends to make one a more socially desirable person.
6. Physical education in schools does not receive the emphasis that it should.
7. Physical education classes are poor in opportunities for worthwhile social experiences.
8. A person would be better off emotionally if he did not participate in physical education.
9. It is possible to make physical education a valuable subject by proper selection of activities.
10. Developing a physical skill brings mental relaxation and relief.
11. Physical education classes provide nothing which will be of value outside the class.
12. There should not be over two one-hour periods per week devoted to physical education in schools.
13. Belonging to a group, for which opportunity is provided in team activities, is a desirable experience for a person.
14. Physical education is an important subject in helping a person gain and maintain all-round good health.
15. No definite beneficial results come from participation in physical education activities.
16. Engaging in group physical education activities is desirable for proper personality development.
17. Physical education activities tend to upset a person emotionally.
18. For its contributions to mental and emotional well-being physical education should be included in the program of every school.

19. I would advise anyone who is physically able to take physical education.
20. As far as improving physical health is concerned a physical education class is a waste of time.
21. Participation in physical education class activities tends to develop a wholesome interest in the functioning of one's body.
22. Physical education classes give a person an opportunity to have a good time.
23. The final mastering of a certain movement or skill in a physical education class brings a pleasurable feeling that one seldom experiences elsewhere.
24. Physical education contributes little toward the improvement of social behavior.
25. Physical education classes provide values which are useful in other parts of daily living.
27. Physical education should be required of all who are physically able to participate.
28. The time devoted to physical education in schools could be more profitably used in study.
29. The skills learned in a physical education class do not add anything of value to a person's life.
30. Physical education does more harm socially than good.

REFERENCES

1. Chesire, L., M. Saffir, and L. L. Thurstone. *Computing Diagrams for the Tetrachoric Correlation Coefficient.* Chicago: University of Chicago Press, 1933.
2. Lindquist, E. F. *Statistical Analysis in Educational Research.* New York: Houghton Mifflin Co., 1940.
3. Thorndike, Robert L. *Personnel Selection.* New York: John Wiley and Sons, 1949.
4. Wear, Carlos L. The Evaluation of Attitude Toward Physical Education as an Activity Course. *Research Quarterly,* **22**: 114-126, 1951.

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Notes and Comments

NOTES

Sportsmanship Attitudes of Sixth, Seventh, and Eighth Grade Boys

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SPORTSMANSHIP attitudes of sixth, seventh, and eighth grade boys were investigated by using a test describing 20 situations commonly encountered in junior high school physical education classes.[1] The following are two typical items from this test.

It is against the rules to pitch side arm, but you know a way to pitch side arm that is hard to detect. If you pitch side arm you know you could win this game and your team would be school champs.

What would you do?

(a) Pitch side arm until the umpire catches you.
(b) Pitch side arm just when the good hitters are up to bat.
(c) Don't pitch side arm at all.
(d) Don't pitch side arm unless you start to lose.

You are the best pitcher on your softball team. The team captain knows this but he wants to be pitcher himself, so he has you play first base. You want to pitch and you don't like first base.

What would you do?

(a) Refuse to play unless you get to pitch.
(b) Do a poor job of playing first base so that you will get changed to something else.
(c) Get the other members of your team to tell the team captain you are the best pitcher.
(d) Play first base as best you can.

The test was administered to 857 sixth, seventh, and eighth grade boys from Inglewood Unified School District, Inglewood, California.

There was found to be a significant difference to the 0.5 per cent level of confidence between the sportsmanship attitudes of sixth, seventh, and eighth grade boys as measured by *The Sportsmanship Preference Record.* On a retest after six months, a reliability coefficient of .80 was found between the results of the original testing and the results of the retest. A correlation coefficient of .53 was found between the physical education teachers' evluation of the boys' sportsmanship attitudes and the test results.

If it is assumed that sportsmanship attitudes should become progressively more desirable as a boy matures, provided he receives proper guidance, then there is indication that the boys in this study were not given proper guidance regarding sportsmanship.

Since the sportsmanship attitudes of the boys in this study became progressively *lower* from the sixth through the eighth grades, there seems to be a need to revise the methods used in teaching sportsmanship.

At present, revised methods of teaching sportsmanship are being practiced at Monroe Junior High School in Inglewood. At the end of the current school year *The Sportsmanship Preference Record* will be readministered and these revised methods will be evaluated. Discussion of the test items themselves has proven to be a valuable tool in the teaching of sportsmanship.

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[1] *The Sportsmanship Preference Record* is the test describing 20 situations referred to in this article. It was developed as a part of a Master's thesis by the author at the University of California, Los Angeles, and is obtainable there.

Research Abstracts

Prepared by the Research Abstracts Committee of the National Council of the Research Section, PAUL A. HUNSICKER, Chairman

Anatomy and Physiology

1. Berg, Roland H., "Exercise Can Help Your Heart." *Look Magazine.* Dec. 14, 1954 pp. 99-103.

An interesting article written by *Look Magazine's* medical director, with comment by the president of the American Heart Association, contains reports of several notable medical authorities on research studies which all indicate exercise with moderation is helpful as a preventive and also may be used to strengthen weakened heart muscles after a heart attack. They believe that physical activity as a part of the job, or as a supplement to it, may be an important ingredient in the magic formula of life longevity.—*J. Grove Wolf.*

2. Harris, R. I. and Ian Macnab. Structural Changes in the Lumbar Intervertebral Discs. *J. Bone and Joint Surg.* (British volume) **36-B:** 2 (May 1954).

One of the common causes of low back pain is disc degeneration. To help understand this problem, the intervertebral discs of 123 lumbar spines were examined at routine necropsies. The relationship of the changes found in the ligaments and intervertebral discs to the radiographic appearance of the spine was studied in detail in order that the necropsy findings could be correlated with the clinical picture of the low back pain syndrome.

Important in the treatment of backache is the fact that the spine acts as an integral whole and that damage in one part will cause injury in other parts. In disc degeneration, for example, there may be damage to the posterior joints, the posterior ligaments, or the extrusion of nuclear material. Radiographs are of great value in diagnosing disc degeneration and of even greater value in assessing the secondary effects that take place. It was concluded that some of the changes that occur have no clinical significance, however, an understanding of what may occur in any or all of the structures involved may serve as a logical basis for attacking the problem of low back pain.—*Frank D. Sills.*

3. Hewitt, Jack E. and Robert L. Hazelwood. "Physiological Conditions Associated with Drowning." *Athletic Journal* **35:** 31-32, 49, 52, 54, 56, 58-60 (Sept. 1954).

Resuscitation is a method of reviving a person, or a method of preventing by use of artifical respiration, asphyxial deaths. Drowning is an accumulation of liquids, usually water, in the respiratory tract in such a manner that suffocation occurs. Four basic stages of asphyxia may occur: (1) Sudden occurrence of apnea (lack of breathing) due to a reflex closing of the glottis and a sudden increase in the blood pressure; (2) Blood pressure continues to rise and respirations become more difficult (dyspnea); (3) Sudden drop in arterial blood pressure with an accompanying cessation of breathing; (4) Final circulatory depression with the heart stopping completely. Revival is generally impossible beyond the early part of the third stage. Cardiovascular and respiratory efficiency may be considered the criteria of successful respiration. Time is of the essence and not a second should be lost in the patient's revival. Comparative results of nine mechanical methods indicate the Schafer Prone method is the least efficient in the amount of pulmonary ventilation secured. The back-pressure arm-lift method (Nielson method) is now recommended.—*J. Grove Wolf.*

4. Jacobson, Lennart, On the relationship between menarcheal age and adult body structure. *Human Biology* **26:** 2 (May 1954) pp. 127-132.

The investigation was based on somatometric and functional data concerning 288 Norwegian adult hospital nurses. The results indicated that, concerning the length, fat, and sturdiness factors, women with a relatively early menstrual onset tend to develop a more pronounced "feminine" adult body structure than do women with a relatively late onset. The three menarcheal age groups were also analyzed in regard to body build proportions. The proportion between the radius and tibia lengths suggested that women with an earlier menarcheal age developed a more pronounced "feminine" adult body-build than do women with a later onset of menstruation. No differences between bi-iliac and bi-acromial breadth were noted between the menarcheal groups concerning these proportions.—*D. B. Van Dalen.*

5. KEYS, ANCEL, Obesity and degenerative heart disease. *American Journal of Public Health* **44**: 864- 871 (Nov. 7, 1954).

This includes a careful review of some of the literature on obesity and heart disease. There are charts on mortality rate and coronary diseases. This study emphasizes the fact that reduction of weight when one is overweight is desirable; however, there need to be large-scale, long-range studies bringing physiological principles to bear in research on population samples if preventive measures are to be effective. Campaigns against overweight cannot substitute for research.—*Joseph E. Lantagne.*

6. TOABE, SIDNEY R. *The Medical Rehabilitation Center in Great Britain. Journal of the Association for Physical and Mental Rehabilitation* **8**: 4 (July-Aug. 1954).

There are 22 medical rehabilitation centers in Great Britain, about half under the guidance of the National Health Service. The major objective of these centers is to insure an early return to work after an accident or injury by providing a full-day program of physical treatment away from the hospital environment.

The medical rehabilitation center may be either residential or non-residential or a combination of the two. Patient load varies, but it is generally considered that for maximum efficiency not more than 100 patients should be in attendance at a center. The staff for a rehabilitation center includes a medical director, administrative secretary, rehabilitation officer, two physical therapists, three remedial gymnasts, two occupational therapists, and a social worker.

A typical unit for a center may be an old country house with spacious grounds remodeled to provide living quarters, recreation rooms, etc. In addition, there is a detached unit for treatment including gymnasium, physical therapy room, occupational therapy rooms, patient dressing rooms, a canteen, medical consulting rooms and possibly a swimming pool.

The typical daily schedule for a patient begins at nine o'clock in the morning and is carried through until five o'clock in the evening. During this time the patient will be given exercises of a general type, specific exercises, work in ambulation, adapted sports activities, and work in any of the other therapies that is needed. Values of this type of treatment are many and include a full day's activities away from the hospital atmosphere, and bring about a more rapid rehabilitation of the patient. Fewer personnel are needed and the cost is less to carry out a program of this type than is generally encountered in traditional rehabilitation of a hospital patient.—*Frank D. Sills.*

Health Education

7. BRAHDY, M. BERNARD and H. GLUCK, "Heartburn." *Today's Health*, **32**: 28-29 (July 1954).

Heartburn is a term generally used to describe a sensation of pressure, fullness, or "burning" in the pit of the stomach or the region of the heart. This feeling may occur either on a full or empty stomach. There is little relationship between the discomfort and the type of food eaten. Heartburn may be functional or nervous. It may be caused by an

organic disorder—ulcers or cancer of the stomach, chronic gallbladder disease, chronic appendicitis, and even heart disease. Heartburn is like a fever; it is a symptom, a sign of disease—not the disease itself. A physician should attempt to find and treat the cause and not merely palliate the symptom.—*J. Grove Wolf.*

8. Editor (reporting for the committee). Recruitment and placement of health education majors. *Journal of School Health* **24**: 5-17. (Jan. 1954).

A summary of the colleges and universities in the U. S. offering graduate and undergraduate health education majors. This training is a more recent development. There are a number of charts with supporting evidence. The Committee reporting left the impression that health education is rapidly gaining status as a unique field of professional study.—*Joseph E. Lantagne.*

9. Fabricant, Noah D., "Controlling the Common Cough." *Today's Health* **32**: 21, 27 (March 1954).

The common cough is caused by irritation of the mucous membrane lining the respiratory tract. Coughing may be due to a large number of infections of the respiratory tract and also may be due to heart disease, tuberculosis, cancer of the lung, tumors of the larynx, and other causes. One of the more common coughs is produced by smoking. Bed rest along with the inhalation of moist air in a moderately warm room is recommended for cough elimination. Antibiotic drugs and sulfonamides are invaluable in serious respiratory infections and should be used upon the advice of a competent physician.—*J. Grove Wolf.*

10. Floyd, W. F. and A. T. Welford, editors, *Symposium on Fatigue.* Published by H. K. Lewis and Co., Ltd., London, England, for the Ergomomics Research Society, 1953. 194 pp.

This is an excellent summary of current thinking on fatigue. It is well illustrated and documented throughout. Each chapter is written by a different author and is in effect his paper presented at the Symposium (March 1952) at the College of Aeronautics, Cranfield, England. Chapters include: Psychological Criteria of Fatigue; Thermal Factors in the Environment which Influence Fatigue; Tropical Fatigue; the Effects of Fatigue on Tremor; Some Effects of Prolonged Muscular Exertion; The Physiological Background of Fatigue; Experiments on Positive and Negative Work; A Factor in Postponing the Onset of Fatigue; Physiological Evaluation of Work in Nykroppa Iron Works; Muscular Potentials as Indicators of Effort in Visual Tasks; Visual Fatigue with Special Reference to Lighting; Fatigue, Fact or Fiction?; Motivation in Measurements of Fatigue; Some Practical Problems of the Alertness Indicator; Work Decrement in the Learning and Retention of Motor Skills; Deterioration of Performance on a Short Term Perceptual Motor Task; Neglect of the Surroundings in Relation to Fatigue Decrements in Output; Satiation and Frustration as Determinants of Fatigue; and The Psychologist's Problem in Measuring Fatigue.

The psychological aspects of fatigue are given greatest emphasis in this comprehensive and interesting report, but it is a worthwhile edition to the library of anyone interested in any approach to the study of fatigue.—*Henry J. Montoye.*

11. Maisel, Albert Q. "Why We Get Tired." *Today's Health* **32**: 32-33, 64-66 (Sept. 1954).

Most experts agree that tiredness is a protective reaction against stress. It is nature's way of expressing that the strains we are putting on our bodies, our minds, or our emotions are approaching a dangerous level. The article discusses the answers to many questions such as How does hard work make us tired? How do emotions affect fatigue? and so forth. Rest and sleep are nature's best method of curing fatigue.—*J. Grove Wolf.*

12. Massler, Maury, et al. A compilation of epidemiologic studies in dental caries. *American Journal of Public Health* **44**: 1357-62 (Oct. 1954).

This study is designed to bring together and analyze all available studies on the epidemiology of dental caries. There are tables and statistical charts which show the number of missing, decayed, and filled teeth per person for ages 3 to 17.—*Joseph E. Lantagne.*

13. Stoney, Edith M. "If Yours Are Migraine Headaches." *Today's Health* **32**: 32-33, 54 (Aug. 1954).

Estimates of from 6 to 12 million have been made of those suffering from migraine headaches in the United States. A recent study at Louisiana State University indicates that only about 18 per cent seek any medical aid. Competent physicians attribute the pain in migraine attacks to the distension of arteries in the brain. A drug called ergotamine tartrate has been successful in the relief of pain to 86 per cent of those afflicted. Combined with caffeine, which appears to increase its effectiveness, this drug may now be administered as a tablet. Headaches are not a disease, they are a symptom, a signal that something is wrong, somewhere. The problem is twofold: (1) How to secure relief; (2) How to prevent attacks.—*J. Grove Wolf.*

14. Turner, C. Naomi. Organic composition of saliva as a possible factor in developing dental caries. *Journal of School Health* **24**: 18-25. (Jan. 1954).

An emphasis is placed on the need for a more careful analysis of saliva and other body fluids to help ascertain the susceptibility to dental caries. The article emphasizes that it is not sufficient to brush teeth, have general improvement of diet, and add fluorine to the water supply; we must further the media in which the teeth are being bathed.—*Joseph E. Lantagne.*

Measurement and Evaluation

15. Anderson, Harold M., A study of certain criteria of teaching effectiveness. *J. of Exper. Educ.* **23**: 1 (Sept. 1954) pp. 41-71.

The teaching effectiveness of 30 teachers was estimated by the use of eight different criteria. The subjects were evaluated on separate types of rating scales by principals, peers, the teacher himself, and an outside agency. No correlation appreciably different from zero was discovered between the evaluations of the teachers on the different rating scales and the evaluations based on the achievements of their pupils in the subject matter areas. Although low, there appears to be a positive association among the assessments of teaching ability made by the principals, pupils, peers, teachers, and the outside agency. A considerable amount of relationship seems to exist between the evaluations of the teachers based on final achievement of their pupils in tests of subject matter when differences in age, intelligence, average scholastic standing, and pretest knowledge are partialed out and the evaluations based on pupil gain in subject matter after the adjustment for differences in initial score.—*D. B. Van Dalen.*

16. Barbe, Walter B. Peer relationships of children of different intelligence levels. *School and Society* **80**: 2040 (Aug. 21, 1954) pp. 60-62.

A total of 244 children with a mean I.Q. of 104 (range: 65-140) on the California S-F Test of Mental Maturity, in grades four to seven, in Kent, Ohio were used. Sociometric procedures determined peer relationships. The findings indicated that children of lower intelligence tended to choose as their friends children with higher intelligence, but not so much higher that their friends were in the gifted group. Bright children chose their friends primarily from the above-average group, but only 30% from among their own I.Q. groups. Bright children were chosen by the average group as friends far more frequently than were the slow learners.—*D. B. Van Dalen.*

17. Erickson, Harley E., A factorial study of teaching ability. *J. of Exp. Educ.* **23**: 1 (Sept. 1954) pp. 1-39.

Sixty-four teachers engaged in their second year of teaching in Wisconsin high schools were chosen for this study. Forty-two variables were used in the analysis. Nine of the variables were estimates of teaching success; seven were derived from the Thurstone Temperament Schedule; 16 from the Cattell 16 Personality Factor Test; and the remaining 10 were University of Wisconsin records. The low correlations of the several temperament, personality, and achievement variables with the nine estimates of teaching success and the three "composites" seems to indicate that the relationship of these measures has not been definitely established. Although low, 33 of the 73 more substantial correlations (.20 or larger) reported in this study were correlations of the nine original and the three "composite" estimates of teaching success with the G, M, and Q_3 scales of the 16 P.F. Test and with practice teaching grade. Each of the 12 correlations involving M (Bohemianism as practical concernedness) was negative, while 36 coefficients involving G (positive character as immature dependent character), Q_3 (will control and character stability), and practice teaching were positive. Due to the consistency of the correlations, as regards sign and magnitude, it would appear that these four measures were slightly related to teaching success.

Since a general factor did not account for the intercorrelations of the estimates of teaching success, the author concluded that these several ratings were not measuring the same "factors." Therefore, the use of a criterion obtained by averaging these nine measures would not be justified. The three derived "composites" of teaching success could be used separately in a program of differential prediction.—*D. B. Van Dalen.*

18. Lehner, George F. J., "Negative Practice as a Psychotherapeutic Technique," *Journal of General Psychology*, **51**: 69-82 (July, 1954).

In this article the author reports on his use of negative practice as a psychotherapeutic technique primarily for cases of stuttering, tics, etc. The value of his work for physical educators, however, lies in a thorough historical review and evaluation of all previous experiments with negative practice, beginning with Dunlap's original alpha, beta, and gamma hypotheses. A careful summarization of important factors in the general application of negative practice provides physical educators with practical guidance for research in the effect of negative practice on the learning of motor skills used in games and sports. The use of this technique in teaching physical education urgently needs exploration.—*Bruce L. Bennett.*

19. Montross, Harold W., Temperament and teaching success. *J. of Exper. Educ.* **23**: 1 (Sept. 1954) pp. 73-97.

Thirty-five teachers were subjects of this study. Aspects of temperament were measured by Thurstone Temperament Schedule, Cattell 16 Personality Factor Test, and a series of objective tests of tempo, fluency, speed, suggestibility, disposition rigidity, and dexterity. Criteria of teaching success was developed from five ratings of each teacher. No significant relationships were found between the seven areas of temperament of the Thurstone Temperament Schedule and the criteria. In the Cattell P. F. Test, only one factor, namely A, appeared significant. This was with composite two and was not consistent with correlation of composite one. When placed in a multiple correlation with measures found significant in the objective tests, however, it increases the value of the multiple correlation from .66 to .71. Five of the objective measures of temperament were found to be significantly correlated with the criteria; namely, Speed of Tapping, Deviation of the Reaction Time in a Positive Direction from the Medium, Fluency, Right and Left Hand Co-ordination, and Maze Number 1. These correlations ranged from .39 to .57. A multiple correlation of .734 was secured for composite one, and of .66 for composite two when these five objective measures were employed in a regression equation.—*D. B. Van Dalen.*

20. WALTERS, A. WILLIAM. Annotated bibliography of publications related to teacher evaluation. *J. of Exp. Educ.* **22**:4 (June 1954) pp. 351-367.

The author investigated and annotated all articles directly related to teacher evaluation. Publications bearing on related topics were omitted. The bibliography includes 99 articles published from May 1949 to March 1953.—*D. B. Van Dalen.*

Miscellaneous

21. ADAMS, J. A. The Effect of Experimentally Indirect Muscular Tension on Psychomotor Performance. *J. Exp. Psychology,* **48**:2 (Aug. 1954).

Using the two-hand Matching Test, the investigation studied the effects of experimentally induced muscular tension on the acquistion of a psychomotor response. Sixty subjects were divided into three experimental groups. Comparison was made with a control group; the results were negative. Experimental groups did not differ importantly from the control group at any stage of training; nor did evidence support the hypothesis that tension would be detrimental to high-ability subjects and beneficial for low ability subjects.—*Edna Willis.*

22. DODSON, DAN W. "The Integration of Negroes in Baseball, *Journal of Educational Sociology* **28**:73-82 (Oct. 1954).

This article describes in detail the problems and planning involved in breaking down the color barrier in professional baseball by the employment of Jackie Robinson after World War II. The author was Executive Director of the Mayor's Committee on Unity in New York City and served as adviser to Branch Rickey, then president of the Brooklyn Dodgers. In conclusion, the author lists twelve principles of integration as possible conclusions from this case study.—*Bruce L. Bennett.*

23. METROPOLITAN LIFE INSURANCE CO. Hazards in competitive athletics. *Statistical Bulletin* **35**:1-3 (June 1954).

Although a sizable number of sports participants sustain injuries in games, there are relatively few fatal injuries. In one insurance experience involving several million males between the ages of 10 and 29 there were only 11 deaths resulting from competitive athletics in the two years 1951-52. This was less than one in every 300 accidental fatalities of all types in this study.

It is difficult to secure meaningful data when attempting to compare one sport with another because participation figures are not readily available. During the five year period 1949-53, football accounted for 94 deaths and boxing for 29. National statistics on most of the other sports are not available.—*Paul Hunsicker.*

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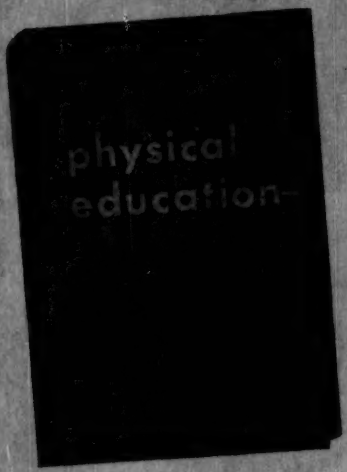

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